MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for November, 1897, is based on 2,864 reports from stations occupied by regular and voluntary observers, classified as follows: 144 from Weather Bureau stations; numerous special river stations; 33 from post surgeons, received through the Surgeon General, United States Army; 2,525 from voluntary observers; 96 received through the Southern Pacific Railway Company; 14 from Life-Saving stations, received through the Superintendent United States Life-Saving Service; 32 from Canadian stations; 20 from Mexican stations; 7 from Jamaica, W. I. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Meteorologist to the Government Survey, Honolulu; Dr. Mariano Bárcena, Director of the Central Meteorological Observatory of Mexico; Mr. Maxwell Hall, Government Meteorologist, Kingston, Jamaica; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; and Commander J. E. Craig, Hydrographer, United States Navy.

The REVIEW is prepared under the general editorial supervision of Prof. Cleveland Abbe.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to generally conform to the modern international system of standard meridians, one hour apart, beginning with Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are generally corrected to agree with the eastern standard; otherwise, the local meridian is mentioned.

STORM WARNINGS AND WEATHER FORECASTS.

By Lieut. Col. H. H. C. DUNWOODY, Supervising Forecast Official.

Under this head it is proposed to make note of all extreme and injurious weather conditions occurring during the month, and the warnings of the same issued by the Bureau, with instances, as far as reported by observers or the press, in which these warnings were of special public benefit. The signals displayed by the Weather Bureau will be referred to as "information," "storm," "hurricane," "cold wave," and "norther," respectively.

The following report on the work of November has been prepared by Mr. H. E. Williams, Chief of Forecast Division.

SEVERE STORMS.

Only three storms of note occurred during the month, viz: Those of November 3–6, 7–10, and 9–12.

The first of these storms originated in western Kansas and moved from Iowa northeast over Lake Michigan and northern Lake Huron on the 5th, and thence easterly to the Gulf of St. Lawrence on the 6th, causing high easterly to northerly winds on the upper, and violent southerly to westerly gales on the lower lakes, a maximum velocity of 60 miles from the west being reported from Buffalo on the morning of the 6th.

Signals for this storm were ordered on western Lake Superior at 5:30 p. m. of the 3d, on Lakes Superior, Michigan, and Huron at 9:40 a. m. of the 5th, on Erie at daybreak of the 5th, and on Ontario at 2:30 p. m. of the 5th. This was the storm in which the ill-fated *Idaho* was lost on Lake Erie. This vessel left Buffalo harbor on the afternoon of the 5th in the face of the storm signals which had been flying there since daybreak.

The second storm developed in Kansas, passed across the lower Lake Region on the 9th, and moved into the Atlantic off the east New England coast on the 10th, causing unusually low pressures along its track, a barometer reading of 29.06 at Oswego at 1 p. m., 29.00 at Portland, and 29.08 at Eastport at 8 p. m. of the 9th, and 28.98 at Halifax at 8 a. m. of the 10th being noted. The highest winds were 44 northwest at Cleveland and 38 northwest at Buffalo during the forenoon, and 40 northwest at Oswego, 56 west at New York, and 60 southwest at Block Island during the afternoon of the 9th. Signals were ordered on eastern Lakes Superior, Michigan, and Huron at 6 p. m. of the 8th, on Erie and Ontario at daylight of the 9th, and on the Atlantic coast from Delaware Breakwater to Eastport at 9:50 a. m. of the 9th.

The third storm appeared north of Montana on the 9th and moved southeast over Lakes Superior and Michigan on the 10th, the center crossing north of the lower Lake Region on the 11th, and passing off the New England coast on the 12th. Velocities of 56 miles at Chicago, 42 at Grand Haven, and 36 at Alpena occurred during the night of the 10th; 48 at Grand Haven, 38 at Sault Ste. Marie, 68 at Cleveland, and 46 at Buffalo during the 11th; 56 at Cleveland, 42 at Erie, 48 at Buffalo, 46 at Boston, and 52 at Eastport during the

night of the 11th; and 44 at Cleveland, 56 at Buffalo, 36 at Oswego, 38 at New York, and 48 at Block Island during the 12th. Signals were ordered on Superior at 10:10 a. m. of the 10th, on Michigan and Huron at 2:30 p. m. of the 10th, and on Erie and Ontario at 9:50 p. m. of the 10th, and from Hatteras to Eastport at 2:30 p. m. of the 11th.

COMMENTS OF THE PRESS.

As showing the value of these warnings and the estimation in which they were held by the interests served, the following extracts are given from newspapers published in cities where signals were displayed, viz:

Editorial, Chronicle, Chicago, Ill., November 4, 1897.—The heavy gales of the last few weeks have demonstrated both the accuracy of the local weather predictions and the seaworthiness of the lake marine. Vesselmen had ample warning of the blow, and many of them deemed discretion the better part of valor and remained in port. Others, however, dared the fury of the 60-mile gale, and it is a tribute to their seamanship and to the stanchness of their vessels that all weathered the blast without serious damage. In point of fact, the sailors of the Great Lakes are inferior to none in the world, and their craft have proved their stability in storms as severe as any that sweep the Atlantic.

Editorial, The Times, Buffalo, N. Y., November 18, 1897.—The captain of the ill-fated *Idaho* went out Friday afternoon, after the weather bureau had warned mariners that a fierce gale was approaching. On Thursday the warning was given: "Sailing vessels and steam barges with tows should use caution where destination can not be reached by Friday evening, as brisk, south winds will become westerly, increasing in force to high."

Storm signals were ordered up Thursday evening, and Friday morning warning was given that the storm and accompanying gale had moved northward to Lake Michigan. Many vessels heeded the warnings and stayed in port, but Captain Gillies, who went down with his wrecked vessel, thought he could weather the storm. The result shows the wisdom of making use of all the safeguards against the dangers of navigation at this perilous season that can be provided. Marine men ought to learn a lesson from the fate of the *Idaho* and its crew.

Leader, Cleveland, Ohio, November 12, 1897.—The storm which swept over the city all day and during the night was decidedly severe. During the early evening and during the night the gale fluctuated between 50 and 67 miles, the latter velocity being within 6 miles of the highest wind ever recorded by the Cleveland weather station. The warning of an approaching storm sounded by the weather department twenty-four hours previous to its arrival was heeded by vessel men as a general rule, the result being the suspension of navigation.

Editorial, Chronicle, Chicago, Ill., November 12, 1897.—The wreck of the steamer *Idaho*, with the loss of twenty lives, off Long Point, last week, points a moral and adorns a tale for lake mariners. The disaster was the result of carelessness and temerity. The *Idaho* was thirty-five years old, and, though not exactly unseaworthy, should not have been exposed to a severe storm. The storm signals were flying when the boat put out of the port of Buffalo to make its way up Lake Erie. Captain Gillies trusted to his own judgment instead of to the warnings of science. He also trusted in the stoutness of an old craft, not fitted for the severe tempests of the season. Small as it is, Lake Erie sees the worst storms that sweep across the lake basin.

We are accustomed to jeer at the Weather Bureau when unheralded storms carry devastation in their tracks across land and sea. Sometimes, perhaps often, forecasts of storms are not fulfilled; but this is only in the case of minor changes from calm to disturbance not seriously affecting navigation nor the pursuits of trade and labor on land. Serious warnings are seldom without cause.

The World, Cleveland, Ohio, November 13, 1897.—From November 1 up to date there have been almost continuous storms all over the Lakes, as was predicted by Inspector Beals, of the local weather office. Despite these storms, however, there were very few accidents reported, save the sinking of the *Idaho*, and her master disobeyed orders in sailing from port when warned of an approaching storm. The storm signals issued at the local office have been true in every instance, and marine men are beginning to look upon the predictions with more credence than ever before.

Plain Dealer, Cleveland, Ohio, November 13, 1897.—The storm of Thursday was one of the severest known in the vicinity of Cleveland, but, owing to the timely warning from the weather bureau, no great damage was done to shipping interests. In fact, every storm this fall has been heralded from twelve to twenty-four hours before its approach, so that all had ample time to be prepared.

The Times, Buffalo, N. Y., November 14, 1897.—The timely warnings of the local weather bureau prevented many vessels from leaving port ten days ago, when the storm prevailed on the Lakes in which the unfortunate steamer *Idaho* went down. At the time of this wreck this paper pointed out that no blame could be attached to Forecaster Cuthbertson's office at any rate, for the office had done its full duty in warning merchants against the dangers of leaving port then.

Again, during the past week the local weather bureau has done the navigation interests invaluable service. It has given warnings of the storms which have prevailed during the week, and undoubtedly has in this way saved two or three million dollars' worth of property, and nobody knows how many lives. Yesterday morning 50 vessels left port after waiting for the storm to blow over. Certainly the navigation interests of the Queen City of the Lakes could ill afford to do without the services of the weather bureau.

Detroit Tribune, Detroit, Mich., November 12, 1897.—The weather bureau at this point issued warnings of the approaching storm last Wednesday and at once ordered up storm signals at points along the entire chain of lakes. The orders were repeated yesterday morning. That much attention was paid to the signals is shown by the fact that the vessel passages at Detroit yesterday were among the lightest in number on record.

Detroit Free Press, Detroit, Mich., November 12, 1897.—It is a fact deserving of praise that every storm this month was seen in the distance and predicted long before it reached the Lakes. For a period of twenty-four to thirty-six hours ahead, the inhabitants of the Lake Region have been told of the coming of each; and as it came closer and immediate conditions could be gauged the public had been given exact details, including direction and velocity of the wind. Some men say this is a matter of luck. There is some excuse for this remark in view of the utter failure of predictions in times past. But there is another side to it. The bureau has, without doubt, been brought to a high state of efficiency. The chief and his assistants have profited by past experience just as every man of sense takes warning of what has gone before, and endeavors to improve on his record. The science of studying the origin and tracks of storms has been refined, and the process of refinement has by no means been completed. New instruments have had much to do with this, but study and application and reasonable deductions have had more.

The natural result is the greater respect paid the bureau, its bulletins, and charts than ever before. The November chart,* containing diagrams of the courses of past storms for that month, has jumped into popular favor. Requests for it are made every day by lake masters, owners, and others. More heed is taken of storm warnings, for the lake sailor has come to look on them as worthy of trust. The one great exception was the starting of the steamer *Idaho* from Buffalo last Friday. The prediction of that storm and its attendant conditions had been made many hours before.

In regard to the storm of the 7–10th, for which signals were ordered on the New England coast at 9:40 a. m. of the 9th, the observer at Block Island reports:

The warnings were thoroughly distributed among the shipping interests, and especially among those interested in fishing.

The wind from the southwest was severe, reaching on the 9th a maximum velocity of 48 miles, and an extreme velocity of 60 miles per hour at 4:08 p. m. The wind attained a much higher velocity on the southwest part of the island, as it is about 150 feet above the office building, and less than a mile distant from it; other obstructions, such as high buildings have a tendency to reduce the wind record. About 8 p. m. the wind changed to northwest and increased in velocity during the night, reaching a maximum velocity of 54 miles per hour at 9:15 p. m., but as the same conditions exist with a northwest wind as with a southwest, we were prevented from obtaining a true velocity. Old reliable residents on the south part of the island inform me that it was one of the severest storms they have ever experienced on that part of the island, and it is estimated that the wind must have attained a hurricane velocity, as it did more damage toward tearing down stone walls, blowing over haystacks, etc., than it usually does with a wind of 60 miles per hour recorded at this office. It is estimated that the damages sustained by the storm on the island will reach $500.

The following fishing smacks dragged anchors in the Great Salt Pond harbor during the northwest wind and went ashore:

Schooners *Arabell, Maud Gertrude, Annie M. Eliza, Vallient*, and sloop *Valkyrie*. They will all be floated at high water excepting smack *Vallient*, which is a very old craft and not worth hauling off.

It is estimated that the amount of damage done to shipping in the harbors, such as carrying away sails, etc., including loss of *Vallient*, will amount to about $1,000. There were about 40 fishing smacks in the harbors, representing a total value of about $70,000, 175 men comprising the crews of the above vessels, who heeded storm warnings and remained in port till the warnings were lowered. The light keeper at Southeast lighthouse informs me that the light tower felt the effects of the wind more than any storm for a long time; it caused the tower to tremble quite severely.

COLD WAVES, FROSTS, ETC.

No cold waves of marked severity occurred during the month. Such cold waves as did occur were amply forecast, and the warnings of them were of considerable benefit.

*The Meteorological Chart of the Great Lakes for November, 1897, published by the Weather Bureau for the use of navigators.

Frosts occurred in the Gulf and South Atlantic States, as follows, viz, on the 3d light frosts in the southern and heavy in the northern portions of Alabama and Mississippi; on the 4th heavy frosts in Alabama, Mississippi, and Georgia, and light in northern Florida; on the 13th light frosts in North Carolina, South Carolina, and northern Florida; on the 17th killing frosts in northern Louisiana and Mississippi; on the 18th light frosts on the Gulf and south Alantic coasts, and killing in the central portions of the Gulf States and in North Carolina. Warnings of these frosts were issued in every case twenty-four hours, and in some cases forty-eight hours, in advance.

On Tuesday, the 16th, a special bulletin issued by the Bureau announced that—

The most decided cold wave of the season is indicated for Wednesday morning throughout the yellow fever districts of the South.

Freezing weather probably will occur throughout the northern and central portions of the Gulf States and in the Ohio Valley Wednesday morning. and frosts generally throughout the Southern States Wednesday and Wednesday night.

And the observer at New Orleans was directed to warn postmasters in the sugar regions of the probable occurrence of freezing weather in the western portion of those districts.

COMMENTS OF THE PRESS.

The following remarks in regard to the warnings of cold waves issued by the Bureau are extracted from the respective newspapers:

Journal, Sioux City, S. Dak., November 22, 1897.—Warnings of these sudden changes of temperature are widely distributed by the Weather Bureau, and are of immense value to all classes of business. The distribution is made through the medium of the newspapers, the telephones, the telegraph, and by means of special bulletins. In Sioux City the two telephone exchanges have about 1,700 subscribers. The central offices receive cold weather warnings from the observer and notify all subscribers who wish such notification. The number taking these warnings is large, consisting largely of commission men, railroad officials, and others having to do with perishable products. If a commission man has perishable freight en route when a cold wave warning is issued he orders it into a roundhouse or other warm building until the danger is past, or he refrains from shipping until the weather becomes more favorable: and, again, the warning is of great value to him in his local business, as certain kinds of fruit can not be exposed to a cold wind without injury.

The value of cold wave and frost warnings is mentioned by the Chief bof the Weather Bureau in his annual report for 1896. He says: "Particular attention is called to the cold wave of unusual severity that overspread nearly the entire United States east of the Rocky Mountains on January 2 to 5, 1896. Warnings of this wave were sent at least twenty-four hours in advance to nearly every station in its path. The Weather Bureau observers at the stations visited by the cold wave report an estimated saving on account of the warnings of over $3,500,000. The estimate, from the nature of the case, could be a partial one only. It is interesting to note the variety of industries benefited. Owners and shippers of perishable produce protected their property from injury by frosts or freezing; owners of residences, factories, and distilleries, and custodians of hospitals and public buildings protected water pipes to prevent bursting; railway officials reguated the size of trains; florists and truck growers protected their hothouses and growing crops; farmers in the south slaughtered their cattle and hogs; river men protected their boats and stock raisers their cattle. In the State of Florida alone, where a large quantity of early garden truck was above ground, the actual figures given by the truck raisers themselves showed a saving by this warning of over $300,000, and this was necessarily only a partial estimate."

The appropriation for the maintenance of the Weather Bureau is about $900,000 per annum, so it will be seen that the saving by reason of this one warning was sufficient to pay the cost of the whole Bureau for a year several times. "This estimated saving is not a wild guess," said Mr. Purssell. "It is not made by the observers, but by the business men themselves, by the men who are liable to loss from sudden changes in temperature. As the report of the Chief says, it is but a partial estimate, and very likely is a good deal short of the amount actually saved. It illustrates, however, the value of the Bureau and its warnings to the business interests of our country."

The Evening Star, Washington, D. C., November 18, 1897.—Many colds have been "caught" by imprudent ones who did not give full credence to the warning given by the Weather Bureau Tuesday that it would be "decidedly colder" Wednesday morning. This warning was amply justified, and its success should encourage some skeptics to place more faith in the forecasts of this branch of the Government service, which works under so many handicaps and with such elusive elements."

In regard to the forecasts and warnings issued during the month for Montana, probably one of the most difficult districts for which to make accurate forecasts, because it is so near the border of the region of observations, the Observer at Havre reports:

More than usual interest has been manifested by the residents in this vicinity, in the daily weather forecasts, during this month (November). With but one exception, the 8th instant, the forecasts for Montana have been so thoroughly verified in this neighborhood that no improvements could be made unless the public should want the exact hours, etc., when the expected weather changes would take place.

The cold-wave warning, forecasts of warmer to-night, rising temperature, snow, continued cold, etc., were all verified to the letter. The warning of the cold wave on the 19th was distributed by extra copies of bulletin, Form No. 1036—Met'l, and cold-wave flag displayed. Special forecast of "High winds, snow, and much colder to-night," Sunday, November 14, was distributed in hotels, open business houses, and elsewhere, and flags displayed.

AREAS OF HIGH AND LOW PRESSURE.

By Prof. H. A. HAZEN.

During November the tracks of 7 highs and 8 lows have been sufficiently well defined to be traced, and are charted on Charts I and II. The following table shows the date and place of origin and disappearance and the duration and velocity of apparent translation of each high and low.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	29, p. m.	49	124	5, p. m.	47	60	4,580	7.0	654	27.3
II	1, p. m.	47	126	8, a. m.	31	80	3,280	6.5	505	21.0
III	6, a. m.	37	124	14, p. m.	34	76	4,100	8.5	482	20.1
IV	14, a. m.	54	118	22, a. m.	29	87	4,090	8.0	511	21.3
V	19, p. m.	54	115	26, a. m.	48	55	4,030	6.5	620	25.8
VI	26, a. m.	52	106	29, a. m.	47	62	2,590	3.0	863	36.0
VII	27, a. m.	50	114	30, p. m.	37	74	2,450	3.5	700	29.2
Total							25,120	43.0	4,335	
Mean of 7 tracks							3,589		619	25.8
Mean of 43 days									584	24.3
Low areas.										
I	29, p. m.	54	106	3, p. m.	48	52	3,940	5.0	788	32.8
II	2, p. m.	44	102	7, p. m.	49	52	3,000	5.0	600	25.0
III	6, p. m.	38	99	10, p. m.	49	53	2,700	4.0	675	28.1
IV	9, p. m.	52	111	13, a. m.	47	56	2,850	3.5	570	23.8
V	11, a. m.	48	128	17, p. m.	46	55	3,970	6.5	611	25.4
VI	17, a. m.	47	127	22, p. m.	48	55	3,870	5.5	704	29.3
VII	20, a. m.	50	126	27, a. m.	48	67	4,000	7.0	571	23.8
VIII	28, p. m.	42	87	30, p. m.	46	58	1,610	2.0	805	33.5
Total							25,940	38.5	5,334	
Mean of 8 tracks							3,242		665	27.7
Mean of 38.5 days									674	28.1

HIGHS.

The general tendency during the month has been for highs to begin or first appear to the north of Montana and take a general southeast track, disappearing off the south Atlantic Coast. Highs Nos. I, II, and III could be traced back to the Pacific Coast; the four last of the month were first noted in Alberta. The highest pressure and lowest temperature of the month occurred in connection with No. VI, on the morning of the 26th, when 31.02 inches and —32° was experienced at Swift Current. The greatest change in temperature and severest cold wave occurred during the prevalence of high area No. V, to the north of Montana. The a. m. observation of the 20th showed a fall in temperature of 46° in twenty-four hours at Havre and of 44° at Helena. The next evening the fall at Helena was 52°, at Rapid City 48°, and at Bismarck 42°. By the morning of the 21st the fall at Rapid City was 46°, at Huron 44°, and at Pierre 43°.

LOWS.

The general direction of the paths has been on a higher parallel of latitude than in the case of the highs. Lows Nos. V, VI, and VII began on the north Pacific Coast; Nos. I and IV began to the north of Montana; Nos. II, III, and VIII began in the central valleys. All the storms, without exception, disappeared over Newfoundland or in the permanent low area of that region.

CLIMATOLOGY OF THE MONTH.

By A. J. HENRY, Chief of Division of Records and Meteorological Data.

GENERAL CHARACTERISTICS.

The month opened with an area of cloud and rain over the lower Mississippi Valley and Gulf States, a region, it will be remembered, in which heavy rains fell during March and April of the current year. Since that time no general storm has originated in or passed over the Gulf States. The rains in the interim have been light and sporadic, and the water in the rivers in many cases has reached as low a point as ever before recorded. At the close of the month there was a notable deficiency of precipitation over all of the country from the Carolinas southward and westward to Oklahoma and Texas. On the other hand, an abundance of rain fell in the Ohio Valley from Cairo to the lower Lake Region; also in New England and generally over the northern Pacific Coast, extending as far eastward as Montana.

Temperature was generally above normal, the only important exception being on the central and north Pacific Coast and over the northern plateau where it was below normal. Killing frost was general throughout Mississippi and Alabama on the 30th, and light to killing frost occurred at many points in Louisiana on the same date. Light frost occurred at New Orleans on the 18th and at Mobile on the 19th.

The first half of the month was an unusually stormy period in the Lake Region, but the number of storms during the last half was not greater than the average for the season.

The most severe storm of the month prevailed on the north Pacific Coast from the morning of the 17th to the morning of the 19th. The anemometer at the Fort Canby station registered 2,380 miles of wind, an average velocity of 63 miles per hour between 11 p. m. of the 16th and 2 p. m. of the 18th, thirty-eight consecutive hours. The wind blew with the greatest velocity (over 70 miles per hour) during the last six hours of the storm's duration.

Some damage was done by the wind at inland points, but the greatest destruction was occasioned by floods in small streams and rivers. Railroad travel was greatly interrupted by landslides, washouts, and destruction of bridges. Fortunately a fall in temperature on the 20th checked what might otherwise have been a very destructive flood throughout Washington and Oregon.

ATMOSPHERIC PRESSURE.

[In inches and hundredths.]

Pressure was below normal over practically the whole Plateau Region and the north Pacific Coast, the greatest deficit being at Walla Walla, Wash. Elsewhere it was above normal, especially in Assiniboia and Manitoba.

The distribution of mean atmospheric pressure reduced to sea level, as shown by mercurial barometers, not reduced to standard gravity, and as determined from observations taken daily at 8 a. m. and 8 p. m. (seventy-fifth meridian time), is shown by isobars on Chart IV. That portion of the reduction to standard gravity that depends on latitude is shown by the numbers printed on the right-hand border.

The numerical values of Table I should be consulted for additional details.

TEMPERATURE OF THE AIR.

[In degrees Fahrenheit.]

Except in the upper half of California, the northern portion of Oregon, thence northward to the boundary line and eastward to Lake Superior, November was warmer than usual. The departures from the normal were not great in any district save over north-central Montana where the average daily deficit was about 10°. There were no very severe cold waves, and the month as a whole presented no striking features as regards temperature.

The mean temperatures and the departures from the normal, as determined from records of the maximum and minimum thermometers, are given in Table I for the regular stations of the Weather Bureau, which also gives the height of the thermometers above the ground at each station. The mean temperature is given for each station in Table II, for voluntary observers.

The *monthly mean temperatures* published in Table I, for the regular stations of the Weather Bureau, are the simple means of all the daily maxima and minima; for voluntary stations a variety of methods of computation is necessarily allowed, as shown by the notes appended to Table II. The mean temperatures given in Table III for Canadian stations are the simple means of 8 a. m. and 8 p. m. simultaneous observations.

The *regular diurnal period* in temperature is shown by the hourly means given in Table V for 29 stations selected out of 82 that maintain continuous thermograph records.

The *distribution of the observed monthly mean* temperature of the air over the United States and Canada is shown by the dotted isotherms on Chart IV; the lines are drawn over the Rocky Mountain Plateau region, although the temperatures have not been reduced to sea level, and the isotherms, therefore, relate to the average surface of the country occupied by our observers; such isotherms are controlled largely by the local topography, and should be drawn and studied in connection with a contour map.

The *years of highest and lowest mean temperatures* for November are shown in Table I of the REVIEW for November, 1894. The mean temperature for the current month was neither the highest nor the lowest on record at any regular station of the Weather Bureau.

The *maximum and minimum temperatures* of the current month are given in Table I. The highest maxima were: 92, Los Angeles (18th); 88, Yuma (2d), Phœnix (19th); 86, Corpus Christi (8th), San Antonio (11th); 85, Jupiter (1st); 84, Abilene (3d), Palestine (15th). Dodge City (20th). The lowest maxima were: 49, Marquette (3d); 54, Sault Ste. Marie (3d), Fort Canby (18th); 55, Eastport (6th); 56, Duluth (2d); 57, Portland, Me., (4th); 59, Detroit (frequently). The highest minima were: 67, Key West (4th); 58, Jupiter (3d); 50, Tampa (13th); 49, Port Eads (2d). The lowest minima were: —26, Miles City (28th); —21, Havre (28th); —19, Williston and Huron (29th).

The *years of highest maximum and lowest minimum temperatures* for November are given in the last four columns of Table I of the REVIEW for November, 1896. During the current month the maximum temperatures were equal to or above

the highest on record at: Williston, 69; La Crosse,* 72; Des Moines, 76; Columbia, Mo., 80; Kansas City, 79; Miles City, 76; Denver,* 77; Dodge City, 84; Wichita, 83; Amarillo, 82; El Paso, 83; Carson City, 72; Baker City, 65; Idaho Falls, 64. The minimum temperatures were equal to or below the lowest on record at: Miles City, —26; Wichita, 7; Point Reyes Light, 41; Fresno, 28.

The *greatest daily range of temperature and the data for computing the extreme and mean monthly ranges* are given for each of the regular Weather Bureau stations in Table I. The largest values of the greatest daily ranges were: Rapid City, 54; Pueblo, 53; Bismarck and Winnemucca, 52; Havre, 50. The smallest values were: Key West, 10; Fort Canby, 13; Astoria and Jupiter, 18; Port Angeles, San Francisco, Marquette, and Woods Hole, 19; Hatteras, 20.

Among the *extreme monthly ranges* the largest were: Miles City, 102; Havre, 92; Huron, 91; Williston and Pierre, 88; Bismarck, 87; Yankton, 86. The smallest values were: Key West, 16; Fort Canby, 20; San Francisco, 24; Jupiter, 27; Astoria, 28; Point Reyes Light, 29.

Considered by districts the mean temperatures of the current month show departures from the normal as given in Table I. The greatest positive departures were: southern and middle Plateaus, 2.2 and 2.1, respectively. The greatest negative departures were: North Dakota, 5.6; Northern Slope, 2.7.

In Canada.—Prof. R. F. Stupart says:

The distribution of mean average temperature for November is not unlike, in many respects, that of its predecessor of 1896, but the amounts above and below average are not so great as they then were. In 1896 the temperature from the Rockies to Lake Superior, starting from the former, ranged from 27° to 9° below the average, whilst this year it is, over the same stretch of country, from 13° to 3° below the average. In British Columbia it then varied from 9° to 24° below the average; from Vancouver Island to the Selkirks now it is from 1° to 12° below. In 1896 southern Ontario was from 3° to 5° above the average; this year it is from 1° to 3° above. There was, however, a noticeable difference in the Maritime Provinces. Last November it was from 1° to 3° above average, and this month it is from average to 2° below.

Accumulated monthly departures from normal temperatures from January 1 to the end of the current month are given in the second column of the following table, and the average departures are given in the third column, for comparison with the departures of current conditions of vegetation from the normal condition.

Districts.	Accumulated departures.		Districts.	Accumulated departures.	
	Total.	Average.		Total.	Average.
	°	°		°	°
New England	+ 4.7	+ 0.4	Florida Peninsula	— 1.4	— 0.1
Middle Atlantic	+ 3.1	+ 0.3	Southern Plateau	— 4.3	— 0.4
South Atlantic	+ 4.5	+ 0.4	Middle Plateau	— 4.6	— 0.4
East Gulf	+ 7.8	+ 0.7	North Pacific	— 1.0	— 0.1
West Gulf	+14.2	+ 1.3	Middle Pacific	— 4.7	— 0.4
Ohio Valley and Tenn.	+ 9.0	+ 0.8	South Pacific	— 7.9	— 0.7
Lower Lake	+ 8.5	+ 0.8			
Upper Lake	+18.7	+ 1.7			
North Dakota	+ 2.5	+ 0.2			
Upper Mississippi Valley	+14.7	+ 1.3			
Missouri Valley	+13.7	+ 1.2			
Northern Slope	+ 2.4	+ 0.2			
Middle Slope	+12.8	+ 1.2			
Southern Slope	+ 3.6	+ 0.3			
Northern Plateau	+ 9.5	+ 0.9			

FROST.

Following is a summary of reports by directors of the respective climate and crop sections south of latitude 37°:

Alabama.—Light frost was quite general in northern section on the 5th to the 14th, inclusive, 19th, 20th, and 21st; in southern section on the 3d, 4th, 7th, 10th, 17th, 18th, and 19th. Killing frost was general in northern section on the 2d and 3d, 12th and 13th, 15th to 20th, 24th, 26th, 28th, and 30th; in southern section, 17th to 20th, inclusive, the first killing of season occurring at Montgomery and as far south as Washington County on the 18th, and as far south as Conecuh and Monroe counties on the 30th. No killing frost was reported at Mobile up to the close of November, though light frost occurred at that station on the 3d, 4th, and 19th.

Arizona.—The first killing frost or the first freezing temperature of the month was reported at different points in the southern half of the State on the following dates: 4th, 7th, 8th, 9th, 25th, and 28th.

Arkansas.—Killing frost was general over the State on the 2d and 3d, 10th, 16th, and 17th, and was reported from a few places the 6th, 11th, 12th, and 18th.

Florida.—Light frosts reported from Washington, Gadsden, Baker, and Duval counties on the 4th, 12th, and 13th. The tenderest plants, however, were uninjured.

Georgia.—Light frost occurred at a number of places in various parts of the State on the 9th, 10th, 11th, 14th, 28th, 29th, and 30th, and was general on the 2d, 4th, 12th, 13th, 18th, 19th, and 20th. Killing frost was reported from the northern section of the State on the 3d, 4th, 5th, 10th, 12th, 13th, and 14th, and was general over the northern and middle sections from the 16th to the 20th, inclusive. Between the 23d and 30th killing frost occurred at a number of places in the northern section and at a few places in the southern section on the 30th.

Louisiana.—There were general frosts throughout the State on the morning of the 17th and near the coast on the 18th.

Mississippi.—Light frost occurred generally over the State, except the Gulf Coast, on the 2d and 3d, and was reported from various localities on the 4th, 6th, 9–13th, 15th, 17–20th, 24th, 28th, and 29th. Killing frost formed over the entire State on the 30th, and was reported from localities in the central and northern portions as early as the 3d.

North Carolina.—Light frosts occurred generally on the 2d, 4th, 5th, 7th, 11th, 12th, 13th; killing frosts occurred generally on the 13th, 18th, 19th, 20th, 24th, 29th, and 30th.

Oklahoma.—The first killing frost, at South McAlester, occurred on the night of the 16th. The first general killing frost of the season was reported on the morning of the 2d, destroying all tender vegetation.

South Carolina.—Killing frost occurred at a few places on the 12–13th, but the first general killing frost of the season occurred on the 18–19th, and 24th, except along the immediate coast, where no killing frosts were noted.

Texas.—The dates of light frosts were as follows: 1st–6th, 8th, 10th, 11th, 17–20th, 22d, 24th, 26–30th. Heavy frosts on the 1st, 16th, and 19th. Killing frosts on the 2d, 15–20th, 25th, and 27–30th.

PRECIPITATION.

[In inches and hundredths.]

Precipitation was unusually heavy on the north Pacific Coast, in eastern Washington and Idaho, and in the Ohio Valley, the lower Lake Region, the Middle States, and New England. Generally less than an inch was recorded at the majority of stations in Florida, Georgia, Alabama, and throughout central Mississippi. Light rains for the season fell in eastern Tennessee, southern West Virginia, and throughout the coast regions of the Carolinas.

Considered by districts the rainfall of the current month was below normal in 12 and above in the remaining 9; the largest excess was 4.70 on the north Pacific Coast; the greatest deficiency was 2.60 on the west Gulf. The values for all districts are shown in Table I.

In Canada.—Professor Stupart says:

At Esquimault, on Vancouver Island, the rainfall was 7.2 inches, being 1.0 inch below the average. Over a large portion of Manitoba the average precipitation for November was not reached, neither was it over the greater portion of the Muskoka District and the Ottawa Valley. Parry Sound and Sprucedale recorded 1.6 and 1.1 inch, respectively, less than the usual amount in the former, and Rockliffe 0.4 less in the latter region. In all other portions of Canada (not, however, considering the mainland of British Columbia, the reports received from this Province being from stations more recently established) the precipitation was generally in excess of the average, and in many localities to a considerable amount. In the Northwest Territories, where precipitation is usually so light, it was exceeded by over an inch in many places and even to an extent of over 2.0 inches. In Ontario, the Niagara Peninsula gave the greatest amount above average; Stony Creek recorded a total fall of 6.6 inches, being 3.6 inches above average. The heaviest general rainfall of the month occurred in the district embracing the Bay of Fundy; St. John recording 6.9 inches, Grand Manan, 8.3; Yarmouth, 7.4, being 2.2, 2.9, and 3.2 inches above the average, respectively.

The *years of greatest and least precipitation* for November are given in the REVIEW for November, 1890. The precipi-

*Observations cover a period of twenty-five years, or more.

tation for the current month was the greatest on record at: Block Island, 9.42; Narragansett Pier, 8.25; Jupiter, 6.49; Cincinnati,* 6.80; Columbus, Ohio, 7.45; Pittsburg,* 5.11; Oswego,* 6.56; Sandusky,* 6.21; Toledo,* 5.41; Rapid City,* 1.16; Spokane, 5.85; Walla Walla, 5.15. It was the least on record at: Tampa, 0.63; Vicksburg,* 1.37; Des Moines, 0.34; Phœnix and Yuma, 0.00.

The *total accumulated monthly departures* from January 1 to the end of the current month are given in the second column of the following table; the third column gives the current accumulated precipitation expressed as a percentage of its normal value.

Districts.	Accumulated departures.	Accumulated precipitation.	Districts.	Accumulated departures.	Accumulated precipitation.
	Inches.	*Per ct.*		*Inches.*	*Per ct.*
New England	+ 0.20	100	Middle Atlantic	— 4.10	90
Florida Peninsula	+11.30	123	South Atlantic	— 4.80	91
Middle Slope	+ 0.60	103	East Gulf	— 5.90	88
Southern Slope	0.00	100	West Gulf	—11.30	72
Southern Plateau	+ 3.70	148	Ohio Valley and Tenn.	— 1.90	95
Middle Plateau	+ 0.30	103	Lower Lake	— 3.50	89
Northern Plateau	+ 2.30	116	Upper Lake	— 2.90	91
South Pacific	+ 0.60	106	North Dakota	— 1.50	92
			Upper Mississippi Valley	— 2.00	94
			Missouri Valley	— 3.80	87
			Northern Slope	— 0.50	96
			North Pacific	— 0.70	99
			Middle Pacific	— 2.80	88

SNOWFALL.

The *total monthly snowfall* at each station, if any occurs, is given in Tables I and II. The geographical distribution of snowfall is shown on Chart VI. It will be seen that snow was general throughout Pennsylvania, New York, and the New England States, also throughout Michigan and the States westward to the Pacific. Practically no snow fell in Kansas except in the extreme northwestern portion. The snowfall of Montana, Idaho, and eastern Washington was quite heavy.

In Canada, Prof. R. F. Stupart reports snow as follows:

British Columbia: Snow on the ground from 6 to 16 inches. Northwest Territories: The precipitation was above the average and was mostly in the form of snow. The observer at Regina says: We have had a good deal of snow, but farther north, in the timber skirting the Qu'Appelle Valley, it is reported that there is at least 2 feet of snow and badly drifted; here there can not be more than 9 inches. From Swift Current a heavy snowfall is reported." Manitoba: Minnedosa, sleighing on the 15th, but roads bare in some places; at Emerson, snowfall only 3 inches. Ontario: The amount of snow on the ground at the end of the month was only from 1 inch in the southern portions to 12 inches in the northern portions. Quebec: Not more than 2 inches of snow reported in this Province. Maritime Provinces: Very little snow, not more than 2.20 inches.

HAIL.

The following are the dates on which hail fell in the respective States:

Arizona, 13. Arkansas, 15. California, 6, 22. Connecticut, 11. Delaware, 15. Idaho, 20. Illinois, 8. Indiana, 11, 26. Maryland, 2, 11, 17. Massachusetts, 9. Missouri, 8, 15. Nevada, 12, 24. New Jersey, 4, 11, 14, 16, 22, 29. New York, 9, 25. North Carolina, 28. North Dakota, 9. Oregon, 5, 6, 7, 13, 14, 16, 21. Pennsylvania, 2, 3, 11, 16. Virginia, 2, 11. West Virginia, 11.

SLEET.

The following are the dates on which sleet fell in the respective States:

Arkansas, 28. California, 6. Connecticut, 8, 15, 29. Idaho, 6, 13, 22, 23, 29. Illinois, 15, 24, 25, 26. Indiana, 1, 9, 11, 24. Iowa, 12, 15, 25, 26. Kansas, 15. Kentucky, 23. Maine, 25, 29. Maryland, 14, 28, 29. Massachusetts, 8, 29. Michigan, 5, 10, 11, 14, 15, 24, 26. Minnesota, 4, 5, 10, 13, 14, 24, 25, 29. Missouri, 15. Montana, 3, 5, 12, 19. Nebraska, 4, 9, 10, 22, 23, 24, 25, 26. Nevada, 3, 6. New Hampshire, 8, 9, 10, 11, 21. New Jersey, 13, 16, 22. New York, 6, 8, 9, 11, 12, 14, 16, 25, 27, 29. North Dakota, 13, 14. Ohio, 7, 9, 11, 12, 14, 16, 19, 22, 24, 25, 29. Oregon, 5, 6, 13, 19, 22, 28, 29, 30. Pennsylvania, 2, 10, 11, 14, 16, 22, 29. Rhode Island, 9. South Dakota, 4, 11, 13. Utah, 6, 24, 25. Vermont, 11, 12, 26. Virginia, 11, 14, 28, 29. Washington, 3, 7, 13, 14, 20, 23, 29, 30. West Virginia, 14, 28, 29. Wisconsin, 5, 10, 11, 14, 15, 25, 26.

* Observations cover a period of over twenty-five years.

WIND.

The *prevailing winds* for November, 1897, viz, those that were recorded most frequently, are shown in Table I for the regular Weather Bureau stations.

The *resultant winds*, as deduced from the personal observations made at 8 a. m. and 8 p. m., are given in Table VIII. These latter resultants are also shown graphically on Chart IV, where the small figure attached to each arrow shows the number of hours that this resultant prevailed, on the assumption that each of the morning and evening observations represents one hour's duration of a uniform wind of average velocity. These figures indicate the relative extent to which winds from different directions counterbalanced each other.

Maximum wind velocities are given in Table I, which also gives the altitudes of Weather Bureau anemometers above the ground. Maxima of 50 miles or more per hour were reported during this month as follows (maximum velocities are averages for five minutes; extreme velocities are gusts of shorter duration, and are not given in this table):

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
		Miles				*Miles*	
Block Island, R.I.	9	54	nw.	Chicago, Ill	1	52	ne.
Buffalo, N. Y	6	56	w.	Do	10	55	sw.
Do	12	54	w.	Do	14	50	se.
Fort Canby, Wash	8	50	se.	Cleveland, Ohio	11	68	w.
Do	9	58	s.	Denver, Colo	10	51	w.
Do	16	66	se.	Eastport, Me	12	60	ne.
Do	17	87	se.	Lexington, Ky	9	50	w.
Do	18	88	se.	New York, N.Y	9	54	w.
Do	20	56	se.	Do	13	52	nw.
Carson City, Nev	10	59	sw.	Portland, Oreg	18	52	s.
Do	19	52	sw.	Woods Hole, Mass	9	57	sw.
Do	21	51	sw.	Do	10	52	w.
Cheyenne Wyo	10	54	w.	Do	12	60	sw.

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IX, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—The dates on which the number of reports of thunderstorms for the whole country were most numerous were: 8th, 64; 9th, 59; 14th, 62; 26th, 58.

Reports were most numerous from: Illinois, 83; Indiana, 49; Missouri, 59; Ohio, 56.

Thunderstorm days were most numerous in: Illinois, 14; Indiana, 10; Missouri and Ohio, 12.

In Canada.—Thunderstorms were reported at Grand Manan on the 6th and 9th.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz, from the 4th to the 12th, inclusive. On the remaining twenty-one days of this month 54 reports were received, or an average of about 2 per day. The dates on which the number of reports of auroras for the whole country especially exceeded this average were: 2d, 4; 17th and 24th, 8.

Reports were most numerous from: Montana, 6; Nevada, 7; North Dakota, 8.

The number of reports was a large percentage of the number of observers in: North Dakota, 17; Montana, 16; Nevada, 15.

In Canada.—Auroras were reported on the following dates: Father Point, 4; Quebec, 16, 17; Toronto, 11; White River, 18; Minnedosa, 15, 16, 21, 24; Medicine Hat, 23, 30; Battleford, 27; Banff, 14.

SUNSHINE AND CLOUDINESS.

The quantity of sunshine, and therefore of heat, received by the atmosphere as a whole is very nearly constant from year to year, but the proportion received by the surface of the earth depends upon the absorption by the atmosphere, and varies largely with the distribution of cloudiness. The sunshine is now recorded automatically at 21 regular stations of the Weather Bureau by its photographic, and at 45 by its thermal effects; at one of these stations records are kept by both methods. The photographic record sheets show the apparent solar time, but the thermometric records show seventy-fifth meridian time; for convenience the results are all given in Table X for each hour of local mean time. In order to complete the record of the duration of cloudiness these registers are supplemented by special personal observations of the state of the sky near the sun in the hours after sunrise and before sunset, and the cloudiness for these hours has been added as a correction to the instrumental records, whence there results a complete record of the duration of sunshine from sunrise to sunset.

The average cloudiness of the whole sky is determined by numerous personal observations at all stations during the daytime, and is given in the column "average cloudiness" in Table I; its complement, or percentage of clear sky, is given in the last column of Table X for the stations at which instrumental self-registers are maintained.

COMPARISON OF DURATIONS AND AREAS.

The sunshine registers give the *durations* of effective sunshine whence the durations relative to possible sunshine are derived; the observers' personal estimates give the percentages of *area* of clear sky. These numbers have no necessary relation to each other, since stationary banks of clouds may obscure the sun without covering the sky, but when all clouds have a steady motion past the sun and are uniformly scattered over the sky, the percentages of duration and of area agree closely. For the sake of comparison, these percentages have been brought together, side by side, in the following table, from which it appears that, in general, the instrumental records of percentages of durations of sunshine are almost always larger than the observers' personal estimates of percentages of area of clear sky; the average excess for November, 1897, is 7 per cent for photographic and 6 per cent for thermometric records.

The details are shown in the accompanying table, in which the stations are arranged according to the *total possible* duration of sunshine, and not according to the *observed* duration. In obtaining the total possible sunshine the value for the parallel of latitude nearest the station is used.

Difference between instrumental and personal observations of sunshine.

Stations.	Latitude.	Apparatus.	For whole month.		Instrumental record of sunshine.			
			Total possible.	Personal.	Photographic.	Difference.	Thermometric.	Difference.
	° ′		*Hrs.*	%	%	%	%	%
Key West, Fla	24 34	T.	328.2	61	.....	.....	73	+12
Tampa, Fla	27 57	T.	323.5	65	.....	.....	68	+ 3
Galveston, Tex	29 18	P.	321.7	61	66	+ 5	.....	.....
New Orleans, La	29 58	T.	319.7	58	.....	.....	57	− 1
Jacksonville, Fla	30 20	T.	319.7	48	.....	.....	63	+15
Savannah, Ga	32 05	P.	315.9	58	66	+ 8	.....	.....
Vicksburg, Miss	32 22	T.	315.9	65	.....	.....	66	+ 1
San Diego, Cal	32 43	P.	314.0	83	85	+ 2	.....	.....
Charleston, S. C.	32 47	T.	314.0	62	.....	.....	64	+ 2
Phœnix, Ariz	33 28	P.	314.0	76	91	+15	.....	.....
Atlanta, Ga	33 45	T.	312.2	65	.....	.....	64	− 1
Los Angeles, Cal	34 03	P.	312.2	81	88	+ 7	.....	.....
Wilmington, N. C.	34 14	T.	312.2	65	.....	.....	72	+ 7
Little Rock, Ark	34 45	T.	310.1	54	.....	.....	73	+19
Chattanooga, Tenn	35 04	T.	310.1	52	.....	.....	56	+ 4
Santa Fe, N. Mex	35 41	P.	308.3	70	81	+11	.....	.....
Raleigh, N. C.	35 45	T.	308.3	56	.....	.....	67	+11
Knoxville, Tenn	35 56	T.	308.3	58	.....	.....	61	+ 3
Nashville, Tenn	36 10	T.	308.3	52	.....	.....	55	+ 3
Fresno, Cal	36 43	T.	305.7	63	.....	.....	78	+15
Dodge City, Kans	37 45	P.	304.0	66	74	+ 8	.....	.....
San Francisco, Cal	37 48	T.	304.0	44	.....	.....	59	+15
Louisville, Ky	38 15	T.	304.0	40	.....	.....	54	+14
St. Louis, Mo	38 38	T.	301.5	46	.....	.....	52	+ 6
Washington, D. C	38 54	P.	301.5	49	55	+ 6	.....	.....
Kansas City, Mo	39 05	P.	301.5	52	53	+ 1	.....	.....
Cincinnati, Ohio	39 06	T.	301.5	43	.....	.....	44	+ 1
Parkersburg, W. Va	39 16	T.	301.5	31	.....	.....	31	0
Baltimore, Md	39 18	T.	301.5	48	.....	.....	55	+ 7
Atlantic City, N. J	39 22	P.	301.5	44	59	+15	.....	.....
Denver, Colo	39 45	P.	299.7	47	66	+19	.....	.....
Indianapolis, Ind	39 46	T.	299.7	33	.....	.....	42	+ 9
Philadelphia, Pa	39 57	T.	299.7	36	.....	.....	47	+11
Columbus, Ohio	39 58	T.	299.7	27	.....	.....	26	− 1
Harrisburg, Pa	40 16	T.	299.7	29	.....	.....	47	+18
Pittsburg, Pa	40 32	T.	297.3	29	.....	.....	34	+ 5
New York, N. Y	40 43	T.	297.3	34	.....	.....	50	+16
Salt Lake City, Utah	40 46	P.	297.3	40	45	+ 5	.....	.....
Eureka, Cal	40 48	P.	297.3	33	33	0	.....	.....
Cheyenne, Wyo	41 08	P.	297.3	52	61	+ 9	.....	.....
Omaha, Nebr	41 16	P.	.....	50	.....	.....	.....	.....
Cleveland, Ohio	41 30	T.	294.9	16	.....	.....	20	+ 4
Des Moines, Iowa	41 35	T.	294.9	55	.....	.....	55	0
Chicago, Ill	41 53	T.	294.9	31	.....	.....	32	+ 1
Erie, Pa	42 07	T.	294.9	26	.....	.....	16	−11
Binghamton, N. Y	42 08	T.	294.9	24	.....	.....	32	+ 8
Detroit, Mich	42 20	T.	294.9	23	.....	.....	27	+ 4
Boston, Mass.	42 21	T.	294.9	32	.....	.....	40	+ 8
Dubuque, Iowa	42 30	T.	294.9	45	.....	.....	42	− 3
Albany, N. Y.	42 39	T.	292.3	22	.....	.....	35	+13
Buffalo, N. Y	42 53	T.	292.3	12	.....	.....	23	+11
Yankton, S. Dak	42 54	T.	292.3	48	.....	.....	58	+10
Rochester, N. Y	43 08	T.	292.3	20	.....	.....	21	+ 1
Idaho Falls, Idaho	43 29	T.	292.3	30	.....	.....	33	+ 3
Portland, Me	43 39	T.	289.7	34	.....	.....	42	+ 8
Northfield, Vt	44 10	P.	289.7	20	27	+ 7	.....	.....
Huron, S. Dak	44 21	T.	289.7	45	.....	.....	47	+ 2
Eastport, Me	44 54	P.	287.2	26	37	+11	.....	.....
St. Paul, Minn	44 58	P.	287.2	37	40	+ 3	.....	.....
Minneapolis, Minn	44 59	T.	287.2	.....	.....	.....	30	.....
Portland, Oreg	45 32	T.	284.1	15	.....	.....	23	+ 8
	45 32	P.	284.1	15	12	− 3	.....	.....
Helena, Mont	46 34	P.	281.0	29	33	+ 4	.....	.....
Bismarck, N. Dak	46 47	P.	281.0	51	61	+10	.....	.....
Tacoma, Wash	47 16	T.	281.0	10	.....	.....	16	+ 6
Seattle, Wash	47 38	T.	278.0	12	.....	.....	4	− 8
Spokane, Wash	47 40	T.	278.0	12	.....	.....	14	+ 2

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following extracts relating to the general weather conditions in the several States and Territories are taken from the monthly reports of the respective sections of the Climate and Crop Service. The name of the section director is given after each summary.

Snowfall and rainfall are expressed in inches.

Alabama.—The mean temperature was 54.6°, or 0.6° above normal; the highest was 85°, at Newburg on the 14th, and the lowest, 21°, at Jasper on the 30th. The average precipitation was 2.03, or 0.97 below normal; the greatest monthly amount, 6.58, occurred at Riverton, and the least, 0.50, at Highland Home.—*F. P. Chaffee.*

Arizona.—The mean temperature was 55.0°, or normal; the highest was 101°, at Maricopa, and the least, 9°, at Snowflake. The average precipitation was 0.02, or 0.83 below normal; the greatest monthly

amount, 0.50, occurred at Oracle, while none fell at numerous stations.—*W. T. Blythe.*

Arkansas.—The mean temperature was 51.6°, or 1.8° above normal; the highest was 88°, at Lutherville on the 15th, and the lowest, 15°, at Silver Springs on the 30th. The average precipitation was 2.82, or 1.53 below normal; the greatest monthly amount, 5.80, occurred at Forest City, and the least, 0.86, at Dardanelle.—*F. H. Clarke.*

California.—The mean temperature was 50.8°, or 2.6° below normal; the highest was 95°, at Volcano Springs on the 2d, and the lowest, 2° below zero, at Bodie on the 8th and 25th. The average precipitation was 1.41, or 1.02 below normal; the greatest monthly amount, 10.45, occurred at Crescent City.—*W. H. Hammon.*

Colorado.—The mean temperature was 37.7°, or 4.8° above normal; the highest was 84°, at Minneapolis on the 20th, and the lowest, 7° below zero, at Steamboat Springs on the 15th. The average precipitation was 0.54, or 0.21 below normal; the greatest monthly amount, 3.50, occurred at Ruby, while none fell at several stations.—*F. H. Brandenburg.*

Florida.—The mean temperature was 67.4°, or 2.3° above normal; the highest was 89°, at Perry on the 1st and 2d, and the lowest, 36°, at Perry on the 12th, and at Wausau on the 14th. The average precipitation was 1.84, or 1.50 below normal; the greatest monthly amount, 6.49, occurred at Jupiter, and the least, trace, at Carrabelle.—*A. J. Mitchell.*

Georgia.—The mean temperature was 55.6°, or 1.9° above normal; the highest was 86°, at Crescent on the 7th and 10th, and the lowest, 21°, at Clayton on the 24th. The average precipitation was 1.48, or 1.62 below normal; the greatest monthly amount, 3.99, occurred at Clayton, and the least, trace, at Fleming.—*J. B. Marbury.*

Idaho.—The mean temperature was 36.4°; the highest was 72°, at Nampa on the 1st, and at Payette on the 3d; and the lowest, 6° below zero, at Swan Valley on the 8th. The average precipitation was 3.18; the greatest monthly amount, 10.98, occurred at Murray, and the least, 0.16, at Gray.—*D. P. McCallum.*

Illinois.—The mean temperature was 40.8°, or 1.7° above normal; the highest was 78°, at Mount Vernon on the 15th, and the lowest, 8° below zero, at Zion on the 29th. The average precipitation was 4.09, or 0.95 above normal; the greatest monthly amount, 7.85, occurred at Robinson, and the least, 1.15, at Scales Mound.—*C. E. Linney.*

Indiana.—The mean temperature was 42.6°, or 1.5° above normal; the highest was 72°, at Washington on the 21st, and the lowest, 6°, at Laporte on the 30th. The average precipitation was 6.54, or 2.62 above normal; the greatest monthly amount, 9.84, occurred at Shelbyville, and the least, 0.88, at Hammond.—*C. F. R. Wappenhans.*

Iowa.—The mean temperature was 34.3°; the highest was 81°, at Albia and Iowa City on the 20th, and the lowest, 19° below zero, at Rock Rapids on the 28th. The average precipitation was 0.66; the greatest monthly amount, 2.24, occurred at Fort Madison, and the least, trace, at Atlantic and Glenwood.—*G. M. Chappel.*

Kansas.—The mean temperature was 42.2°, or 1.8° above normal; the highest was 89°, at Englewood on the 20th, and the lowest, 1° below zero, at Eureka Ranch on the 29th. The average precipitation was 0.27, or 0.59 below normal; the greatest monthly amount, 1.25, occurred at Kansas City, while none fell at several stations.—*T. B. Jennings.*

Kentucky.—The mean temperature was 47.8°, or 2.5° above normal; the highest was 78°, at Canton on the 8th, at Paducah on the 21st, and at Pilot Oak on two days; the lowest was 12°, at Loretto on the 30th. The average precipitation was 4.69, or 0.67 above normal; the greatest monthly amount, 9.29, occurred at Owenton, and the least, 2.34, at Eubank.—*Frank Burke.*

Louisiana.—The mean temperature was 60.5°, or 2.1° above normal; the highest was 89°, at Lawrence on the 27th and at Plaquemine on the 20th, and the lowest, 23°, at Robeline on the 18th. The average precipitation was 3.06, or 0.76 below normal; the greatest monthly amount, 7.39, occurred at Jeanerette, and the least, 0.65, at Venice.—*R. E. Kerkam.*

Maryland and Delaware.—The mean temperature was 45.0°, or 1.3° above normal; the highest was 80°, at Newmarket, Md., on the 15th, and the lowest, 8°, at Grantsville, Md., on the 24th. The average precipitation was 4.69, or 1.56 above normal; the greatest monthly amount, 8.43, occurred at Bachmans Valley, Md., and the least, 1.59, at Pocomoke City, Md.—*F. J. Walz.*

Michigan.—The mean temperature was 33.9°, or 1.2° below normal; the highest was 69°, at Mount Clemens on the 1st, and the lowest, 11° below zero, at Iron River on the 27th. The average precipitation was 3.12, or 0.15 above normal; the greatest monthly amount, 6.03, occurred at Fitchburg, and the least, 0.85, at Gladwin.—*C. F. Schneider.*

Minnesota.—The mean temperature was 26.6°, or 0.6° above normal; the highest was 79°, at Luverne on the 3d, and the lowest, 22° below zero, at Koochiching on the 28th. The average precipitation was 0.53, or 0.61 below normal; the greatest monthly amount, 1.30, occurred at Tower, and the least, 0.04, at Ada.—*T. S. Outram.*

Mississippi.—The mean temperature was 56.0°, or 2.3° above normal; the highest was 89°, at French Camp on the 22d, at Palo Alto on the 15th, and at Waynesboro on the 1st; the lowest was 22°, at French Camp on the 30th. The average precipitation was 2.45, or 2.19 below normal, the greatest monthly amount, 6.44, occurred at Corinth, and the least, 0.72, at Agricultural College.—*R. J. Hyatt.*

Missouri.—The mean temperature was 43.3°, or 1.8° above normal; the highest was 82°, at Zeitonia on the 13th, and the lowest, 3° below zero, at Maryville and Pickering on the 29th. The average precipitation was 2.51, or 0.07 above normal; the greatest monthly amount, 6.21, occurred at St. Louis, and the least, 0.27, at Conception.—*A. E. Hackett.*

Montana.—The mean temperature was 26.2°, or 2.8° below normal; the highest was 77°, at Fort Benton on the 19th, and the lowest, 35° below zero, on the 28th. The average precipitation was 2.36, or 0.21 above normal; the greatest monthly amount, 10.04, occurred at Columbia Falls, and the least, 0.25, at Wibaux.—*J. Warren Smith.*

Nebraska.—The mean temperature was 34.9°, or 0.4° above normal; the highest was 84°, at Lodgepole on the 13th, and the lowest, 16° below zero, at Valentine on the 29th. The average precipitation was 0.51, or 0.19 below normal; the greatest monthly amount, 1.74, occurred at Kennedy, and the least, trace, at Madrid, Seneca, and Wilber.—*G. A. Loreland.*

Nevada.—The mean temperature was 40.3°, or 2.0° above normal; the highest was 77°, at Candelaria on the 18th, and the lowest, 6° below zero, at Empire Ranch on the 15th. The average precipitation was 0.69, or 0.02 below normal; the greatest monthly amount, 3.66, occurred at Lewers Ranch, while none fell at Hot Springs, Mill City, and Las Vegas.—*R. F. Young.*

New England.—The mean temperature was 36.9°, or 0.7° below normal; the highest was 68°, at numerous stations in southern New England on the 6th and 16th; the lowest was 3° below zero, at Hartland, Vt., on the 24th. The average precipitation was 6.38, or 2.51 above normal; the greatest monthly amount, 10.25, occurred at Kingston, R. I., and the least, 2.69, at Kineo, Me.—*J. W. Smith.*

New Jersey.—The mean temperature was 43.8°, or 0.4° above normal; the highest was 75°, at Toms River on the 16th, and the lowest, 10°, at Franklin Furnace on the 24th. The average precipitation was 4.59, or 0.93 above normal; the greatest monthly amount, 5.95, occurred at Belvidere, and the least, 2.42, at Cape May City.—*E. W. McGann.*

New Mexico.—The mean temperature was 46.5°, or 2.6° above normal; the highest was 87°, at Roswell on the 21st, and the lowest, 5° below zero, at Buckmans on the 27th. The average precipitation was decidedly below normal; the greatest monthly amount, 0.78, occurred at Angus Ranch, while none fell at numerous stations.—*H. B. Hersey.*

New York.—The mean temperature was 38.4°, or 0.6° above normal; the highest was 70°, at Bedford on the 4th, and the lowest, 3° below zero, at Number Four on the 24th. The average precipitation was 4.74, or 1.59 above normal; the greatest monthly amount, 10.02, occurred at Glens Falls, and the least, 2.19, at Avon.—*R. M. Hardinge.*

North Carolina.—The mean temperature was 51.3°, or 1.6° above normal; the highest was 79°, at Newbern on the 5th and at Tarboro on the 16th, and the lowest, 12°, at Linville on the 24th. The average precipitation was 2.89, or 0.45 below normal; the greatest monthly amount, 5.71, occurred at Greenville, and the least, 0.82, at Rockingham.—*C. F. von Herrmann.*

North Dakota.—The mean temperature was 20.0°, or 0.3° above normal; the highest was 86°, at Berthold Agency on the 19th, and the lowest, 28° below zero, at Bottineau on the 27th. The average precipitation was 0.32, or 0.63 below normal; the greatest monthly amount, 1.07, occurred at Hamilton, and the least, trace, at Ashley, Dunseith, Ellendale, and Glenullin.—*B. H. Bronson.*

Ohio.—The mean temperature was 42.2°, or 1.5° above normal; the highest was 76°, at Thurman on the 1st and at Portsmouth on the 4th, and the lowest, 8°, at Levering on the 30th. The average precipitation was 6.62, or 3.36 above normal; the greatest monthly amount, 10.18, occurred at New Paris, and the least, 3.84, at Dupont.—*H. W. Richardson.*

Oklahoma.—The mean temperature was 49.6°; the highest was 95°, at Anadarko on the 8th, and the lowest, 7°, at Arapaho on the 29th. The average precipitation was 0.51; the greatest monthly amount, 1.61, occurred at Burnett, while none fell at Jefferson and Waukomis.—*J. I. Widmeyer.*

Oregon.—The mean temperature was 42.6°, or 2.8° below normal; the highest was 82°, at Prineville on the 2d, and the lowest, 2°, at Burns on the 23d. The average precipitation was 9.30, or 3.96 above normal; the greatest monthly amount, 32.91, occurred at Glenora, and the least, 0.13, at Silver Lake.—*B. S. Pague.*

Pennsylvania.—The mean temperature was 41.6°, or 1.8° above normal; the highest was 76°, at Cannonsburg on the 4th, and the lowest, 2°, at Dyberry on the 24th. The average precipitation was 5.28, or 2.13 above normal; the greatest monthly amount, 7.04, occurred at Hamburg, and the least, 2.37, at Reedsville.—*T. F. Townsend.*

South Carolina.—The mean temperature was 55.3°, or 0.2° above normal; the highest was 88°, at Trial on the 12th, and the lowest, 23°, at Holland on the 19th, and at Walhalla on the 30th. The average precipitation was 1.99, or 0.62 below normal; the greatest monthly amount, 5.05, occurred at Gaffney, and the least, 0.26, at Gillisonville.—*J. W. Bauer.*

South Dakota.—The mean temperature was 26.0°, or 0.8° below normal; the highest was 88°, at Cherry Creek on the 2d, and the lowest, 26° below zero, at Ladelle on the 29th, and at Nowlin on the 26th. The average precipitation was 0.59, or 0.06 above normal; the greatest monthly amount, 2.70, occurred at Oelrichs, and the least, trace, at Cherry Creek and Shiloh.—*S. W. Glenn.*

Tennessee.—The mean temperature was 49.5°, or about 2.0° above normal; the highest was 79°, at St. Joseph on the 14th and 15th, and at Union City on the 22d, and the lowest, 13°, at Rugby on the 30th. The average precipitation was 3.10, or about 0.75 below normal; the greatest monthly amount, 6.90, occurred at Hickory Withe, and the least, 0.69, at Bristol.—*H. C. Bate.*

Texas.—The mean temperature for the State during the month was 1.2° above the normal. There was a general excess throughout the State except over the western portion of west Texas and the central portion of north Texas, where there was a deficiency ranging from 0.3° to 1.9°, with the greatest deficit in the vicinity of Weatherford. The excess ranged from 0.3° to 3.1° over central Texas, the panhandle, the western portion of north Texas, and the eastern portions of north and west Texas, and from 0.1° to 3.9° over southwest Texas and the coast district. Temperature was generally normal over east Texas. The greatest excess was in the vicinity of Fort McIntosh. The highest was 96°, at Camp Eagle Pass on the 4th, and the lowest, 8°, at Tulia on the 29th. The precipitation on an average for the State during the month was 1.88 below the normal. There was a general deficiency in all localities except at Fort Ringgold and Fort Brown, where there was an excess. The deficiency ranged from 0.24 to 1.78 over central and west Texas and the panhandle, from 0.66 to 3.38 over southwest Texas and the coast district except in the vicinity of Fort Ringgold. The greatest monthly amount, 3.03, occurred at Fort Brown, while none fell at several stations.—*I. M. Cline.*

Utah.—The mean temperature was 39.3°; the highest was 78°, at Fillmore on the 2d, and the lowest, 1° below zero, at Loa on the 8th and at Soldier Summit on the 24th. The average precipitation was 0.96, or about 0.50 below normal; the greatest monthly amount, 2.44, occurred at Logan, and the least, 0.04, at Pahreah.—*J. H. Smith.*

Virginia.—The mean temperature was 46.5°, or slightly above normal; the highest was 80°, at Ashland on the 16th, and the lowest, 10°, at Burkes Garden on the 24th. The average precipitation was 2.49, or 0.01 above normal; the greatest monthly amount, 4.37, occurred at Bonair, and the least, 0.69, at Bristol.—*E. A. Evans.*

Washington.—The mean temperature was 39.4°, or 2.0° below normal; the highest was 75°, at Walla Walla on the 18th, and the lowest, 10° below zero, at Waterville on the 28th. The average precipitation was 9.13, or 2.90 above normal; the greatest monthly amount, 23.85, occurred at Clearwater, and the least, 0.75, at Loomis.—*G. N. Salisbury.*

West Virginia.—The mean temperature was 45.0°, or 1.0° above normal; the highest was 76°, at Eastbank and Green Sulphur Springs on the 26th and at Uppertract on the 6th. The average precipitation was 4.45, or 1.50 above normal; the greatest monthly amount, 7.15, occurred at Kingwood, and the least, 0.30, at Beckly.—*H. L. Ball.*

Wisconsin.—The mean temperature was 30.4°, or 0.3° above normal; the highest was 79°, at Medford on the 3d, and the lowest, 25° below zero, at Osceola Mills on the 27th. The average precipitation was 1.32, or 0.46 below normal; the greatest monthly amount, 2.99, occurred at Oconto, and the least, 0.04, at Medford.—*W. M. Wilson.*

Wyoming.—The mean temperature was 33.4°, or 1.4° above normal; the highest was 76°, at Wheatland on the 2d, at Fort Laramie on the 3d, and at Sheridan on the 19th; the lowest was 16° below zero, at Sheridan on the 29th. The average precipitation was 0.88, or 0.08 below normal; the greatest monthly amount, 2.98, occurred at Fort Yellowstone, and the least, 0.12, at Carbon.—*W. S. Palmer.*

RIVER AND FLOOD SERVICE.

By PARK MORRILL, Forecast Official, in charge of River and Flood Service.

The period of low water has been unusually protracted this year. As a rule, the annual rise in all the rivers, except the upper Mississippi, the Missouri, and the Arkansas, is well underway by the first of November. This year the Ohio rose first, and that but slightly, the rise beginning on November 7. The lower Mississippi followed with a slow rise during the latter half of November, but the other rivers remain at low ebb. At all points the rivers are below their normal height. The Mississippi, at Keokuk, at the end of November was 1.5 foot below its normal stage; at St. Louis, 3.4 feet; at Cairo, 7.6 feet; at Memphis, 7.3 feet; and at Vicksburg, 14.2 feet. The Arkansas River, at Little Rock, at the same time was 4.7 feet below its normal stage; the Red, at Shreveport, 9.8 feet; and the Ohio, at Cincinnati, 1.5 below. The rising condition of the Ohio and the lower Mississippi and the stationary low stage of other rivers of the Mississippi system are seen in the hydrographs for the month.

The highest and lowest water, mean stage, and monthly range at 116 river stations are given in the accompanying table. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are: Keokuk, St. Louis, Cairo, Memphis, and Vicksburg, on the Mississippi; Cincinnati, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.

The following résumé of river stages and conditions of navigation in the respective streams is compiled from reports by the officials of the Weather Bureau at various river stations and section centers:

Atlantic Coast Rivers. (Reported by A. F. Sims, Albany, N. Y.; E. R. Demain, Harrisburg, Pa.; E. A. Evans, Richmond, Va.; C. F. von Herrmann, Raleigh, N. C.; L. N. Jesunofsky, Charleston, S. C.; D. Fisher, Augusta, Ga.; and J. B. Marbury, Atlanta, Ga.)—The heavy rain of the 1st and 2d of November found its way to tide-water rapidly, so that by the 4th of the month the Hudson River at Albany was 4 feet above the normal. The stream flowing by the intake of the Albany City Waterworks was very turbid, and the city pumps were shut down in consequence. A dense fog, the heaviest thus far this season, prevailed along the Hudson on the 5th; one could not see objects across the river and buildings near by seemed mere shadows; the sun a dull red blot in the gray sky. At 10 a. m. the fog lifted and soon cleared away. Light snow fell on the upper watershed on the 13th.

Observations of temperature of water were commenced on the morning of the 18th; the temperature of the water in the Hudson at Albany was 39.5° on that date. On the 19th the river temperature was 37.5° at top and bottom; thin ice, the first of the season, formed along the edges of the basin in the vicinity of Green Island. The fall in temperature on the 18th and 19th checked the flow of surface water on the upper watershed and caused the river to fall to its normal height at Albany. On the 23d thin ice formed in the Erie Canal slips; thin ice formed in the Albany basin during the night of the 23d and 24th. The cold wave of the 23d lowered the air temperature to 12.5° and the water temperature to 35.5°.

On the 28th there was a 4-foot freshet in the river and swift current conditions, not conducive to a freeze-up. The fall in temperature experienced during the night of the 28th checked the flow of surface water in the feeders and lowered the tide-water portion of the Hudson 1 foot. At the end of the month the Hudson was high for the season, very turbid, and the current abnormally swift.

All river interests have made preparation to go into winter quarters; the Albany basins have already taken on a winter aspect. Some of the International Dredging Company's boats, used on the Hudson River improvements, are now being dismantled, and other boats, requiring extensive overhauling, are now in winter berths. Forwarding agents have ceased to take cargoes for points along the upper portion of the Hudson on account of the risk involved in unloading boats in shallow water at this season of the year. The last decade of November was replete with calls for river information, and no small measure of reward for our work comes with the increased confidence manifested by all river interests in the work of the Weather Bureau.

As a result of the rain, averaging 1.75 inch, which began to fall early on the morning of November 1, and continued steadily until the night of the 2d, throughout the greater portion of the Susquehanna basin, the low stages of water prevailing in all streams of the system at the end of October were followed during the first few days of November by a general rise, ranging from a fraction of a foot to 4.5 feet at the different reporting stations. Frequent, well distributed rains during the rest of the month maintained and gradually increased the flow, and November closed with higher stages of water at most of the stations than have been reported since May. The average stage of water was about 0.5 foot lower than during the same period last year, notwithstanding the fact that there was an increase of about 50 per cent in the rainfall as compared with November, 1896. The rainfall at Harrisburg (4.09 inches) was, with two exceptions, the largest amount that has fallen in November during the past ten years, and exceeded the normal by 1.12 inch. It is believed Harrisburg represents, approximately, the conditions obtaining generally over the watershed. The apparent discrepancy between rainfall and river stages in the streams the past month is due to the fact that at the beginning of the month the streams were so much lower than at the same time last year that a large percentage of the rainfall was required to give the same flow as

obtained at the beginning of November, 1896. The increased rainfall and rising waters have carried a great quantity of coal culm into the Susquehanna, and the water at Harrisburg, and probably at all points below the coal fields, is black and almost unfit for use.

With the exception of a few days in the first and last decades the James River remained below the zero of the gauge at Richmond throughout the month. Showers over the river basin during the last day of October and the 1st and 2d of November caused a slight temporary rise, during which the water reached a maximum of 1.0 foot on the gauge on the 3d. The river then declined slowly and steadily to —0.3 foot, at which point it remained stationary until the 30th, when another slight rise occurred. No unusual conditions were present at any time, the stream remaining at about its normal November stage.

The general conditions which have made the present year so noteworthy in the hydrographic history of North Carolina continued during November, although all the rivers maintained slightly higher stages than last month. Heavy rains occurred on the 1st and 2d of November, chiefly over the basin of the Cape Fear River, which responded by a moderate rise on the 3d to a stage of nearly 10 feet. Then followed another period of extremely dry weather from the 3d to the 26th with practically no precipitation anywhere, during which the rivers declined to relatively low stages, but slightly modified by the light rains of the 26th to 29th. The northern rivers have hardly been influenced at all, the Dan, at Clarksville, remaining slightly above the zero of the gauge the entire month.

The month opened with general and moderate rainfall over the upper river basins of South Carolina, but owing to the unusually low gauge readings then prevailing the amount of drainage was scarcely sufficient to maintain navigable stages on some of the streams from the 1st to the 5th. Navigation on the Peedee above Gibson, 60 miles upstream from Smiths Mills, was suspended the entire month. At Cheraw the gauge registered 0.9 foot from the 14th to the 24th, this being the most prolonged stage of low water recorded in ten years, and within 0.9 foot of the extreme low water of August 27, 1866. Between Winyah Bay and Smiths Mills steamers made regular trips from the 1st to the 17th. After the 17th the water had receded to such a low stage (1 foot) that navigation became absolutely dangerous from snags, and the trips were discontinued. These conditions have not occurred on the lower Pedee since the establishment of the river service in 1890. The 4-foot rise at Cheraw on the 28th had not reached Smiths Mills by the 30th, and steamers could not reach the latter point. The Congaree, at and below Columbia, was unnavigable during the entire month.

Although very low water prevailed throughout the month, regular trips were made up the Waccamaw to Conway. The only rise of any note upon this stream was 1.2 foot, which occurred between the 27th and 30th. Owing to scant steamboat water there was but little merchandise carried up to the Edisto from the 1st to the 14th. Navigation was suspended between the 15th and 30th. The logging season has begun on the upper Edisto; there is at present considerable newly cut timber in readiness for booming in that locality. The Lynch River was open for navigation to small steamers of light draught from Smiths Mills to Effingham. This stream rose 1.9 foot from the 4th to the 9th; there was a rapid fall of 2.7 feet on the 10th and 11th. Practically no business at all was done upon the Lumber River. The Little Pedee showed corresponding fluctuations, with the exception of navigable water from Port Harrelson, at its confluence with the Pedee, up to Centenary from the 2d to the 9th. Traffic was quite brisk up the Black River from Winyah Bay to Harpers; beyond Harpers, and extending up to Kingstree, the low-water stages did not even admit of steamers of light draught plying.

The brackishness of the lower Black, the lower Pedee, and lower Waccamaw rivers, noted in the last report, continued unabated, and have been somewhat intensified, as there was less rain than in October. Many of the mill owners along the streams, whose boilers are fast corroding from the use of the intruding salt water, are drawing spring-water long distances to feed their boilers. Others have bored deep wells upon their mill property, and utilized the artesian water for boilers. The most successful in this respect is the Gardner & Lacey Lumber Company of Georgetown. After boring to a depth of 560 feet a vein was struck yielding a constant flow of 55 gallons to the minute. The water is clear, entirely free of sodium, which is so destructive to boilers, and pleasant to the taste. The success attained in this work of deep well borings has proved highly satisfactory. The constantly brackish condition of the river water over the upper Winyah Bay section during dry seasons has entailed much loss of labor and time to the sawmill and rice interests in past years.

The quantity of rainfall throughout the Savannah Valley during November was below the normal over the central and lower basin, and in consequence the river was barely at a navigable stage for the greater portion of the month; the difficulties in boating that were encountered in the previous month were again repeated, and but few trips were made with even approximately full cargoes. Cotton, which forms the chief commodity of river traffic at this season of the year, was mostly shipped by rail from points along the water route, entailing an additional expense to the planter and a consequent loss to the boating interests.

Abnormally dry weather prevailed throughout the drainage area of the other rivers of Georgia, and as a consequence very low water continued, rendering navigation impossible. At Columbus, Ga., there are several steamboats resting on sandbars and unable to move until a sufficient rise comes to float them.

Mobile River and branches. (Reported by F. P. Chaffee, Montgomery, Ala., and W. M. Dudley, Mobile, Ala.)—The rainfall over the watershed of the Alabama River was so light and scattered during this month as to have little effect on the rivers of this system. Low waters prevailed in all the tributaries, and stages below zero of gauge ruled in Alabama during the entire month, during which steamboat traffic was suspended on account of low water. Many of the creeks and smaller streams were entirely dry during the greater portion of the month.

Heavy rains on the 1st caused general but slight rises in the Tombigbee and its tributaries on the 1st and 2d. The rivers showed but slight variation until the 9th, when the general rain on that date caused slight rises in the rivers, extending to the 11th, when they began falling, and so continued until the 27th. The light rain reported on the morning of the 29th caused a slight rise to the close of the month. The rivers remained below the zero of gauge during the entire month. Boats ran regularly during the month, but low stages prevented them going so high as Demopolis.

Ohio River and branches. (Reported by F. Ridgway, Pittsburg, Pa.; H. L. Ball, Parkersburg, W. Va.; S. S. Bassler, Cincinnati, Ohio; F. Burke, Louisville, Ky.; P. H. Smyth, Cairo, Ill.; L. M. Pindell, Chattanooga, Tenn.; and H. C. Bate, Nashville, Tenn.) — Owing to the fact that navigation has been practically closed since the last week of September, and was not reopened until the rains of the first decade of the month, greater activity in boating interests than is usually displayed at this season of the year characterized this month. The long continued drought had so parched the valleys at the headwaters of the Ohio that considerable rainfall occurred before the rivers were materially affected, but after the first ten days of the month the valleys of the smaller tributaries had become so saturated that a moderate amount of rainfall would sustain uninterrupted navigation for "packet" boats. The rains of the 15th, 16th, and 17th were sufficient to cause a rise in the Ohio river to the "barge" stage on the 18th and 19th, while the rainfall on the 23d and 27th swelled the Monongahela and Alleghany rivers to such an extent as to cause a "coal-boating" stage in the Ohio on the 28th and 29th. This rise, being quickly taken advantage of, continued long enough to permit of the shipping of the entire supply of coal that had been stored in the harbor here for the down-river markets. During the first five days of this rise 13,929,000 bushels of coal passed Davis Island on its way to southern ports.

The recent general rise in the Alleghany and its tributaries, where open navigation obtains, has enabled timber operators and others to ship into the Pittsburg markets their entire season's product of timber, lumber, barges, boats, etc., from all points within 200 miles of this port. Necessarily this month's increase in the stage of the rivers will interfere with all construction work that may be in progress in the streams; but, on the other hand, it has proven of inestimable value to the general public depending on the Ohio River for its coal supply.

The Ohio at Parkersburg at the opening of the month showed a stage of 0.9 foot, the lowest of the month. Moderately heavy rains fell over West Virginia on the 1st, 2d, and 3d, and these caused a slow rise in all the rivers. Rains were frequent during the first half of the month, and the rise in the rivers, though light, was steady and continuous. On the 9th light craft began running on the Ohio, and by the 15th boats of moderate draught were plying. A stage of 10 feet was reached at Parkersburg on the 18th, and navigation was then open to all craft. After the 21st the river fell slowly to a stage of 6 feet on the 26th, but general rain occurred about that time and started the third rise of the month. At Parkersburg a maximum stage of 13.7 feet was reached on the 30th. The tributary rivers of West Virginia were very low at the opening of the month, but the frequent rains brought a change, and by the 15th all the navigable rivers were running freely. After a long period of dullness business was quickly resumed, and at the close of the month was reported as brisk and increasing in volume.

The low stage of water at Cincinnati and consequent suspension of river business, which characterized the months of September and October, continued during the first week of November, after which a sudden rise in the Licking caused a rise in the Ohio, which was reinforced by a rise from the upper Ohio. On this rise the *Telegraph* left for Louisville, the first sidewheel steamer to leave port in thirty-seven days. The latter part of the month the river had a rising tendency and reached a stage sufficient to float a big fleet of Pittsburg coal boats, bringing coal to this and lower markets, on the 23d. This rise was opportune, since the supply of coal on hand was rapidly being exhausted. In the latter part of the month navigation was more or less active, though a better stage of water is necessary to meet the requirements of the river business that has been delayed by reason of the prevailing low water.

The river at Louisville maintained too low a stage during the first eight days of the month to permit navigation of any other than very light boats. The rains of the 8th and 9th caused a sharp rise, however, which lasted but a few days, the river then relapsing into its former state. On the 17th a rise began, which continued gradually and almost

without cessation to the close of the month. The water was sufficiently high to permit of the running of some of the heavier class of boats, and, also, to cause the suspension of the operations of the United States engineers on the falls.

At Evansville, from the 1st until the morning of the 10th, the river stage changed but little, with a general rising tendency. On the 10th a more marked rise began which continued until the 14th. The river then fell for four days, when another rise set in which continued until the end of the month.

At Paducah and Cairo the river was very nearly at a stand from the 1st to the 9th, but during the 2d and 3d decades material improvement was in progress, except for a slight fall covering a period of three or four days. A fair stage of water obtained at Cairo and Paducah at the close of the month. The Paducah and Cairo Packet Company resumed trips between Paducah and Cairo on the 22d, and the Tennessee Packet Company extended their trips up the Ohio to Paducah on the 26th. The steamer *Buckeye State*, from the upper Ohio, arrived at Cairo on the 28th, resuming her regular trips between Cincinnati and Memphis. This steamer has, on account of low water, been laid up at Cincinnati since last August. A second steamer from the upper Ohio is expected to reach Cairo by December 1. River business has materially improved since the first evidence of a better stage of water, and with continued improvement in the river a general revival of business is expected. Freight offerings are reported to be very free.

At Riverton, Ala., Speers Ferry, Va., and Florence, Ala., the river was below the zero of the gauge the entire month. At Chattanooga the lowest stage was 0.7 foot on the 17th and from the 21st to 29th; the river reached the same stage in 1894. The lowest stage recorded since 1879 was 0.6 of a foot on December 17, 1894. Practically speaking navigation was closed to all but very light-draught boats during the entire month from Riverton to the headwaters. Once or twice during the month the small boat *Ocoee* attempted to go to Kingston, but abandoned the trip and was forced to confine her operations to this section, between Chattanooga and Pinhook. The rainfall ranged from 0.35 inch to 2.66 inches below the normal over the entire system, except at Riverton, Ala., where the rainfall was 2.58 inches in excess. The continued low stage of the river has proven disastrous to river traffic on the Tennessee.

During the month of November, 1897, navigation was closed on the Cumberland River all the month, but the river was rising on December 1, and gave promise of a favorable stage of water in the next few days.

Mississippi River and branches, except the Ohio. (Reported by P. F. Lyons, St. Paul, Minn.; M. J. Wright, Jr., La Crosse, Wis.; G. E. Hunt, Davenport, Iowa; F. Z. Gosewisch, Keokuk, Iowa; H. C. Frankenfield, St. Louis, Mo.; P. H. Smyth, Cairo, Ill.; S. C. Emery, Memphis, Tenn.; R. J. Hyatt, Vicksburg, Miss.; R. E. Kerkam, New Orleans, La.; L. A. Welsh, Omaha, Nebr.; P. Connor, Kansas City, Mo.; F. H. Clarke, Little Rock, Ark.; J. J. O'Donnell, Fort Smith, Ark.; and C. Davis, Shreveport, La.)—Aside from a better stage of water than that for any other November since 1894, as indicated by the extreme gauge readings of 3.9 and 2.3 feet at St. Paul, there is scarcely anything to be said about the rivers of Minnesota for this month. Running ice, the first of the season, appeared on the 23d; and on the 27th, during a sharp cold wave, the Mississippi was nearly choked up with it, and on the succeeding morning was gorged and frozen so that gauge readings could not be made accurately. No sign of river craft of any kind was seen during the month, except in the vicinity of Hastings, Minn., where work on river improvements in charge of the Government engineers was prosecuted to the 10th, when it was suspended for the winter, and the boats put in winter quarters at that place.

The stage of water in the Mississippi River at La Crosse ranged from 3.8 feet on the 1st to 2.3 feet on the 28th. The average stage of water for the month was 2.9 feet. Navigation closed on the 17th. The steamer *Linehan* was the last boat to pass through the drawbridge this season. She went up the river with the *Ethel Howard* at 5 p. m. of the 17th. From the 23d to the 28th the river was covered with floating ice. On the 27th Root River and all sloughs in this vicinity were frozen over, and on the 29th the Mississippi was frozen from both shores nearly to the channel, and in consequence the gauge readings were discontinued on that date. Rafting and Government improvements were discontinued about the middle of the month. The rafting season just closed has been a very successful one.

The water fell rapidly at Dubuque during the last few days of the month, owing to accumulating ice above. The same is true, in a less degree, of several other stations. The river was reported frozen at North McGregor on the 27th and at Leclaire on the 29th. The freezing of the river at Leclaire stopped navigation above Davenport, but the ferryboat was still running at the latter place on the 30th. The rainfall for the month was generally deficient throughout the upper Mississippi Valley.

The river at Keokuk has been at a low stage throughout the month, and the month closes with the lowest stage of the year. Navigation, which has been confined to a few light-draught boats, closed on the 20th, the Des Moines Rapids Canal closing for the season on that date. The first running ice appeared on the 29th, and, at the close of the month, the river is covered with floating ice from 3 to 4 inches in thickness.

Thin ice appeared along the banks of the Mississippi at Burlington on the 28th; it commenced to run on the 29th, and by the 30th the whole river at that point was filled with floating ice, which came to a standstill during the day on account of the cold weather, and commenced to knit into a firm bridge. Ice commenced running past Quincy and Hannibal on the 29th and past Louisiana on the 30th, but none was observed farther south. Light-draught boats continued to ply on the rivers during the greater portion of the month. On the 26th the steamers *D. H. Pike* and *Spread Eagle* were withdrawn from the Illinois River and Alton-Grafton trades, respectively, and left for their winter quarters at Paducah.

Between St. Louis and the mouth of the Ohio the Mississippi continued practically stationary during the month, the greatest 24-hour change being a rise of 0.3 foot at Chester, Ill. The stage of water at the close of the month was 0.2 to 0.5 foot higher than at the opening. A rise out of the Ohio commenced passing Cairo on the 9th, and by the 12th the river was rising from Cairo to Memphis. This rise continued at Cairo until the 18th. A second rise started in at Cairo on the 22d, and was still in progress at the close of the month.

Several towboats, that have been laid up at St. Louis during the extreme low water, came out to Cairo between the 17th and 21st. The Anchor Line steamers plying between St. Louis and New Orleans, but laid up at Cairo on account of low water, will probably resume trips to the south during the first week in December.

The unusually low stages prevailing during October from Cairo to Helena practically continued up to November 15, as the rise over the greater portion of this territory up to that time had been only one-half of a foot. During the last half of the month the river, responding to a good rise in the Ohio, came up more rapidly, and by the end of November a total rise of about 4 feet had occurred at Cairo and Helena, and a little less than 3 feet been added to the Memphis stage, the maximum at the latter place being 2.8 feet, which was reached on the 30th. The monthly average at Memphis was 6.5 feet below the normal for November and 3.3 feet below the recorded stage of 1896. The rise during the month, though slight, was sufficient to cause a very perceptible improvement in navigation throughout this section; accidents became less frequent, and with the general and heavy rains the outlook at the close of the month is favorable for good boating stages in all the rivers in this section. The large shipments which have been delayed on account of the quarantine regulations are now being made, and these, added to the natural volume of business common to this season of the year, together with the large amount of cotton to be moved, is causing unusual activity on the river, and every available boat is brought into service. A large amount of coal is on its way to this section, there being now sufficient water for the movement of a good sized fleet. A large number of snags have been removed by the Government during the month.

Below Memphis the Mississippi and its tributaries were low but navigable during the month, except the Yazoo, which continued closed by the sandbar at its mouth. The rise of the Mississippi toward the close of the month gave assurance of sufficient water at an early date for boats to cross the bar at the mouth of the Yazoo, opening the navigation of that river to the Mississippi. The end of the quarantine on account of the yellow fever about the middle of the month opened up river business with a rush. All boats commenced carrying full cargoes, with good passenger traffic; much cotton was ready for market and awaiting transportation. A new line of steamers has been organized for traffic on the Yazoo and its tributaries by the Vicksburg and Yazoo Transportation Company. The steamer *Memphis*, a recent purchase of the company, will make the first trip from Vicksburg on the 7th of December, by which time there will be ample water for navigation in the Yazoo and its branches.

The Mississippi, below Vicksburg, continued at a low stage during the entire month, the range near Vicksburg being less than 3 feet, and at New Orleans slightly less than a foot and a half. Quarantine regulations in force during the greater part of the month prohibited river navigation to any great extent until its close, when traffic was resumed.

A remarkable feature in connection with the lower Red and Ouachita rivers was that no station on these rivers reported an extreme monthly fluctuation of even as much as 1 foot. There was but little rainfall and the stages continued low, the lower Red readings being below the zero of gauge, and those of the lower Ouachita less than a foot above. Quarantine regulations and the low stages prohibited navigation to any extent, although during the latter part of the month freight was carried on the Ouachita to Harrisonburg, La., on light-draught boats.

The Arkansas River continued at a remarkably low stage during the entire month, averaging 0.8 foot at Fort Smith, —0.5 foot at Dardanelle, and 1.2 foot at Little Rock. The river remained almost stationary at all stations, the extreme fluctuation being 0.3 foot at Fort Smith and 0.2 foot at Dardanelle and Little Rock. Navigation was entirely suspended between Fort Smith and Little Rock, and nearly so on the lower river, the only actual navigation being carried on for a distance of 60 miles up the river from its mouth.

On and after November 10 ice was reported running in the Missouri River above Yankton. By the 17th ice was running so heavily at Fort Pierre as to make the crossing of the river in small boats dangerous. The ferryboat stopped running at Pierre on the 18th, stopping all cattle

shipments until the ice is strong enough to cross on. Ice began running at Sioux City on the 23d, and continued at intervals until the afternoon of the 27th, when the channel became blocked and the ice froze fast, effectually closing navigation at that point.

At Omaha the river continued to fall slowly until the 28th, reaching the lowest point, 3.0 feet above the zero of gauge, on that date. Ice began running on the 22d, and continued until the morning of the 28th, when the river became frozen from bank to bank. On the 29th pedestrians were crossing on the ice. At St. Joseph ice began running on the 27th. On the 29th a gorge formed at the Burlington and Missouri river railroad bridge, and continued at the close of the month.

There was a rise at Kansas City of 1.2 foot during the first decade on account of rain, and a very slow fall afterwards to the end of the month. The range was from 5.0 to 6.2 feet. There was a little shore ice at the end of the month.

Rivers on the Pacific Coast. (Reported by W. H. Hammon, San Francisco, Cal.; J. A. Barwick, Sacramento, Cal.; and B. S. Pague, Portland, Oreg.)—The Sacramento river at Sacramento stood at 8.8 feet on the 1st, and remained stationary until the 20th, when, owing to the general rains from the 20th to 24th, it began to rise on the 21st, and attained a crest of 13.3 feet on the 25th. From the 25th to the end of the month the river fell slowly to a stage of 10.2 feet on the 30th. The other rivers in the northern portion of California showed similar conditions to those in the Sacramento, that is, a stationary stage until the 20th, then a slight rise until the 25th, and then a fall until the last of the month.

Low but not unusual stages of the rivers of Oregon and Washington prevailed during the fore part of the month, but the later rains caused a rise from the 5th. The rises in the Columbia and Snake were not as marked as in the Willamette and the small rivers of western Washington. The height was normal until the 18th, when, owing to heavy rains and snow in the mountains, and chinook winds on the 18th, the rivers and streams west of the Cascades, in Oregon and Washington, had a rapid rise. In the twenty-four hours to 11 a. m. of the 19th the Willamette rose 4.5 feet, and during the succeeding twenty-four hours, 1.4 foot. In western Washington, in the deep, narrow streams, the rise was more marked, and considerable damage was done along streams emptying into Puget Sound from the east. The rise in the Columbia and Snake was beneficial to navigation. During the month large quantities of wheat were carried on steamers from Lewiston, Idaho, to rail shipment at Riparia, and many ships left their docks in Portland, Oreg., loaded with wheat and flour. The wheat shipments by water for China, Japan, England, and France during November amounted to more than 2,000,000 bushels.

Heights of rivers above zeros of gauges, November, 1897.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Mississippi River.	*Miles*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Paul, Minn.	1,957	14	3.9	2-4	2.3	27	3.4	1.6
Reeds Landing, Minn.	1,887	12	2.6	1,2	1.0	30	1.8	1.6
La Crosse, Wis.	1,822	10	3.8	1	2.3	30	2.9	1.5
North McGregor, Iowa	1,762	18	3.4	1	1.5	28	2.5	1.9
Dubuque, Iowa	1,702	15	3.4	1,2	0.2	30	2.4	3.2
Leclaire, Iowa	1,612	10	1.9	2,3	0.2	30	1.3	1.7
Davenport, Iowa	1,566	15	2.9	3	0.5	30	2.3	1.4
Keokuk, Iowa	1,466	14	1.8	7-10	0.9	29,30	1.3	0.9
Hannibal, Mo	1,405	17	2.6	8,10	1.4	30	2.1	1.2
Grafton, Ill	1,307	23	3.7	9	2.8	1	3.2	0.9
St. Louis, Mo.	1,264	30	4.1	12,16	3.1	1,4,5	3.6	1.0
Chester, Ill.	1,189	30	2.4	17	1.7	1-7	2.0	0.7
Cairo, Ill	1,073	40	7.0	30	2.6	9	4.3	4.4
Memphis, Tenn	843	33	2.8	29,30	0.4	1,2	1.3	2.4
Helena, Ark	767	44	2.9	30	— 0.6	1	0.7	3.5
Arkansas City, Ark.	635	42	0.9	30	— 2.3	1	—1.2	3.2
Greenville, Miss	595	40	1.1	30	— 1.1	2-4	—0.4	2.2
Vicksburg, Miss	474	41	— 0.5	30	— 3.4	5-12	—2.5	2.9
New Orleans, La	108	16	3.8	28-30	2.4	7	3.0	1.4
Arkansas River.								
Fort Smith, Ark.	345	22	0.9	17-22	0.6	1	0.8	0.3
Dardanelle, Ark.	250	21	— 0.5	{5-12, 17-} {21, 25-29}	— 0.7	1-3	—0.5	0.2
Little Rock, Ark.	170	23	1.3	1,25-28	1.1	{3-15,} {19-23}	1.2	0.2
Wichita, Kans.	720	10	0.9	25-30	0.7	21-22	0.8	0.2
White River.								
Newport, Ark	150	26	0.5	20-23	0.3	13-19	0.4	0.2
Des Moines River.								
Des Moines, Iowa.	150	19	3.9	9-28	3.7	1-4	3.9	0.2
Illinois River.								
Peoria, Ill.	135	14	4.9	27	3.8	1-5	4.2	1.1
Missouri River.								
Bismarck, N. Dak.	1,201	14	3.4	21-23	1.7	17	2.5	1.7
Pierre, S. Dak.	1,006	14	1.5	8	— 1.1	27	0.9	2.6
Sioux City, Iowa	676	19	5.6	1	4.1	25	4.7	1.5
Omaha, Nebr.	561	18	5.3	1,19-27	5.1	6-12	5.2	0.2
St. Joseph, Mo.	373	10	1.4	5,6	— 1.3	30	1.0	2.7
Kansas City, Mo.	280	21	6.2	7,8	5.0	1	5.7	1.2
Boonville, Mo.	191	30	5.2	9-10	4.1	2-4	4.7	1.1
Hermann, Mo.	98	21	— 0.4	27-28	— 1.4	4,5	—0.6	1.0
Ohio River.								
Pittsburg, Pa	966	22	10.7	29	2.8	23	6.0	7.9
Davis Island Dam, Pa.	960	25	11.3	29	1.4	1	4.8	9.9
Wheeling, W. Va.	875	36	13.6	29	0.5	1	5.1	13.1
Parkersburg, W. Va.	785	35	13.7	30	0.9	1	5.7	12.8

Heights of rivers above zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger-line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Ohio River—Cont'd.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Point Pleasant, W. Va.	703	36	9.5	29	0.9	2-5	4.4	8.6
Catlettsburg, Ky	651	50	11.8	21	1.7	6	5.3	10.1
Portsmouth, Ohio	612	50	12.5	21	1.8	3-7	6.2	10.7
Cincinnati, Ohio	499	45	13.6	23	3.2	6,7	8.0	10.4
Louisville, Ky.	367	24	6.9	28	3.9	16	5.4	3.0
Evansville, Ind	184	30	9.3	30	0.7	1-4	4.3	8.6
Paducah, Ky.	47	40	4.8	30	0.0	7-9	1.7	4.8
Alleghany River.								
Warren, Pa	177	7	4.2	28	0.0	1,10	0.9	4.2
Oil City, Pa	123	13	5.2	28	0.0	1	1.4	5.2
Parkers Landing, Pa.	73	30	6.5	28	— 0.4	1	1.7	6.9
Freeport, Pa.	26	30	9.8	28,29	0.4	1	3.5	9.4
Conemaugh River.								
Johnstown, Pa.	64	7	3.8	16	0.5	1	2.1	3.3
Red Bank Creek.								
Brookville, Pa.	35	8	2.8	27	— 0.2	1,2	0.8	3.0
Beaver River.								
Ellwood Junction, Pa.	10	14	1.4	17,18	— 1.3	1,2	0.0	2.7
Cumberland River.								
Burnside, Ky	434	50	0.3	29	— 0.7	1	—0.2	1.0
Carthage, Tenn.	257	30	0.9	27,30	0.1	1,2,5	0.4	0.8
Nashville, Tenn	175	40	1.4	30	0.2	1,4	0.6	1.2
Great Kanawha River.								
Charleston, W. Va.	61	30	6.9	29,30	6.2	8	6.5	0.7
New River.								
Hinton, W. Va.	95	14	1.5	4,5	1.0	1,2,12-29	1.1	0.5
Licking River.								
Falmouth, Ky.	30	25	13.4	9	0.2	1	2.4	13.2
Miami River.								
Dayton, Ohio	69	18	4.8	17	0.8	1	2.2	4.0
Monongahela River.								
Weston, W. Va	161	18	5.0	27	— 2.5	1-8	0.2	7.5
Fairmont, W. Va	119	25	6.0	28	— 0.7	1-9	1.1	6.7
Greensboro, Pa.	81	18	11.6	28	4.5	1	7.4	7.1
Lock No. 4, Pa.	40	28	13.5	28	4.4	7,8	8.2	9.1
Cheat River.								
Rowlesburg, W. Va.	36	14	7.2	10	— 0.7	1	2.8	7.9
Youghiogheny River.								
Confluence, Pa.	59	10	3.5	15	0.1	1	1.9	3.4
West Newton, Pa.	15	23	3.9	28	— 0.2	1,2	1.4	4.1
Muskingum River.								
Zanesville, Ohio	70	20	11.0	18	5.3	1	7.2	5.7
Tennessee River.								
Knoxville, Tenn.	614	29	0.8	20,21	0.1	1-3	0.5	0.7
Kingston, Tenn	534	25	0.1	4	0.0	1-3,5-30	0.0	0.1
Chattanooga, Tenn.	430	33	1.4	8	0.7	21-29	0.9	0.7
Bridgeport, Ala	390	24	0.4	9	— 0.1	25-27	0.1	0.5
Florence, Ala	220	16	0.2	11	— 0.2	22-30	0.0	0.4
Johnsonville, Tenn.	94	21	0.6	1,2	— 0.1	29,30	0.3	0.7
Clinch River.								
Speers Ferry, Va.	156	20	— 0.5	1,2,9,10	— 0.8	{16, 17, 20} {21, 25, 26}	—0.7	0.3
Clinton, Tenn	46	25	3.2	16-19	2.2	30	2.8	1.0
Wabash River.								
Mount Carmel, Ill	50	15	4.1	21-22	0.5	1	2.2	3.6
Red River.								
Arthur City, Tex.	688	27	2.5	1	2.1	{18-20,} {27-30}	2.2	0.4
Fulton, Ark	565	28	1.4	1-9,17	1.0	24-30	1.2	0.4
Shreveport, La.	449	20	— 1.5	1,2	— 2.0	23-30	—1.8	0.5
Alexandria, La	139	33	— 2.3	4-8	— 3.1	24-28	—2.7	0.8
Atchafalaya Bayou.								
Melville, La.	100*	31	2.4	1,30	1.3	19	1.8	1.1
Ouachita River.								
Camden, Ark.	340	39	3.4	28-30	2.7	1	3.0	0.7
Monroe, La	100	40	0.9	11-13	0.2	1,22,23	0.5	0.7
Yazoo River.								
Yazoo City, Miss.	80	25	— 1.7	7,8	— 2.4	{15, 16,} {19, 20}	—2.2	0.7
Chattahoochee River.								
Columbus, Ga.	140	20	1.4	30	— 1.4	2	—0.4	2.8
Flint River.								
Albany, Ga.	80	20	1.5	5	0.9	1-3,28,29	1.1	0.6
Cape Fear River.								
Fayetteville, N. C.	100	38	9.3	4	1.4	25	3.0	7.9
Columbia River.								
Umatilla, Oreg	270	25	6.2	23	1.5	12	3.7	4.7
The Dalles, Oreg.	166	40	9.8	23	2.4	5	5.4	7.4
Willamette River.								
Albany, Oreg	99	20	14.2	21	1.0	1-4	5.7	13.2
Portland, Oreg	10	15	12.9	20	0.4	3	6.0	12.5
Edisto River.								
Edisto, S. C	75	6	3.5	1,2	2.4	27,28	2.8	1.1
James River.								
Lynchburg, Va.	257	18	0.9	2	— 0.2	19-28	0.0	1.1
Richmond, Va.	110	12	1.0	3	— 0.3	24-27	0.0	1.3
Alabama River.								
Montgomery, Ala.	265	35	— 0.4	10,11	— 0.1	{1,4,5,} {20-26}	—0.8	0.6
Selma, Ala.	212	35	— 0.7	13	— 1.8	18-26	—1.5	1.1
Coosa River.								
Gadsden, Ala	144	18	0.0	28,29	— 0.4	1,13-26	—0.3	0.4
Tombigbee River.								
Columbus, Miss.	285	33	— 3.0	2	— 3.7	24-28	—3.5	0.7
Demopolis, Ala.	155	35	— 1.9	10-13	— 2.5	1	—2.2	0.6
Black Warrior River.								
Tuscaloosa, Ala.	90	38	— 1.1	10-12	— 1.4	1,19-27	—1.3	0.3
Pedee River.								
Cheraw, S. C.	145	27	4.5	29	0.8	{16-18} {23, 24, 28}	1.4	3.7
Black River.								
Kingstree, S. C.	60	12	5.0	6	3.4	29-30	4.2	1.6

Heights of rivers above zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Lumber River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Fairbluff, N.C	10	6	1.7	13	0.1	22, 24, 29	0.8	1.6
Lynch Creek.								
Effingham, S. C	35	12	6.4	9	2.7	24	3.8	3.7
Potomac River.								
Harpers Ferry, W. Va	170	16	2.0	12, 18	0.3	1	1.2	1.7
Roanoke River.								
Clarksville, Va	155	12	0.5	29	0.1	1, 2, 5-27	0.1	0.4
Sacramento River.								
Redbluff, Cal	241	23	1.4	22	0.3	1, 2, 7-15	0.5	1.1
Sacramento, Cal	70	25	13.3	24	8.7	1-20	9.6	4.6
Santee River.								
St. Stephens, S. C	50	12	3.3	7	— 0.3	26, 27	0.9	3.6
Congaree River.								
Columbia, S. C	37	15	3.0	28	1.5	1-26	1.6	1.5

Heights of rivers above zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Wateree River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Camden, S. C	45	24	7.7	29	2.2	24, 25	3.2	5.5
Savannah River.								
Augusta, Ga	130	32	9.4	29	4.8	24	5.7	4.6
Susquehanna River.								
Wilkesbarre, Pa	178	14	6.0	29	0.0	1-3	2.0	6.0
Harrisburg, Pa	70	17	4.9	30	0.7	1	2.8	4.2
Juniata River.								
Huntingdon, Pa	80	24	4.2	3, 10	2.8	1	3.5	1.4
W. Br. of Susquehanna.								
Williamsport, Pa	35	20	5.7	29	0.4	1	2.9	5.3
Waccamaw River.								
Conway, S. C	40	7	2.1	1, 2	0.2	19-22	0.8	1.9

*Distance to Gulf of Mexico.

SPECIAL CONTRIBUTIONS.

RECENT PUBLICATIONS.

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CLIMATOLOGICAL DATA FOR JAMAICA, W. I.

Through the kindness of Mr. Maxwell Hall, of Montego Bay, Jamaica, the meteorological service of that colony has acceded to the request of the Editor for the prompt communication of an abstract of the very interesting climatological records of that highly important West Indian service. The climatological summary for November, 1897, furnished by Mr. Hall, through his assistant, Mr. Robert Johnstone, of the Meteorological Office, is reproduced in the following table. For descriptive details of the stations and instruments see pages 308 and 356.

Jamaica, W. I., climatological data, November, 1897.

	Morant Point Lighthouse.	Negril Point Lighthouse.	Kingston.	Kings House.	Castleton Gardens.	Hope Gardens.	Stony Hill Reformatory.	Hill Gardens (Cin. Plant.)
Latitude	17°56′	18° 16′	17° 58′	.....	18° 12′	.....	.....	18°05′
Longitude	76°10′	78° 23′	76° 48′	.....	76° 50′	.....	.....	76°39′
Elevation (feet)	8	33	50	400	580	600	1,400	4,907
Mean barometer 7 a. m.	29.918	29.925	29.931	.....	29.588	.....	.....	25.355
Mean barometer 3 p. m	29.862	28.861	29.862	.....	29.563	.....	.....	25.331
Mean temperature 7 a. m.	81.5	75.3	72.7	.....	70.7	.....	.....	60.5
Mean temperature 3 p. m.	83.9	83.1	83.8	.....	80.2	.....	.....	65.8
Mean of maxima	.....	86.1	88.6	.....	84.3	.....	.....	69.8
Mean of minima	.....	71.4	71.2	.....	66.3	.....	.....	57.3
Highest maximum	.....	89	90.7	.....	88	.....	.....	75
Lowest minimum	.....	67	68.7	.....	62	.....	.....	54
Mean dew-point 7 a. m.	.....	72.1	68.5	.....	68.0	.....	.....	56.3
Mean dew-point 3 p. m.	.....	72.3	71.0	.....	72.4	.....	.....	61.5
Mean relative humidity 7 a. m.	.....	90	87	.....	90	.....	.....	83
Mean relative humidity 3 p. m.	.....	71	66	.....	76	.....	.....	85
Monthly rainfall (inches)	4.10	4.32	0.48	.....	12.08	.....	.....	11.09
Average daily wind movement	.....	189.0	34.5	.....	.....	.....	.....	30.8
Average wind direction 7 a. m.	*	ne.	n.	.....	.....	.....	.....	e.
Average wind direction 3 p. m.	ne.	var.	var.	.....	.....	.....	.....	se.
Average hourly velocity 7 a. m.	8.1	6.3	1.3	.....	.....	.....	.....	.....
Average hourly velocity 3 p. m	11.0	11.5	3.0	.....	.....	.....	.....	.....
Average cloudiness (tenths):								
7 a. m. Lower clouds	3.0	0.5	0.1	.....	.....	.....	.....	.....
7 a. m. Middle clouds	2.4	1.9	0.1	.....	.....	.....	.....	.....
7 a. m. Upper clouds	1.1	4.1	2.8	.....	.....	.....	.....	.....
3 p. m. Lower clouds	3.0	4.2	1.5	.....	.....	.....	.....	.....
3 p. m. Middle clouds	1.4	2.6	1.4	.....	.....	.....	.....	.....
3 p. m. Upper clouds	0.9	1.0	2.3	.....	.....	.....	.....	.....

*ne. by n.

MEXICAN CLIMATOLOGICAL DATA.

Through the kind cooperation of Señor Mariano Bárcena, Director, and Señor José Zendejas, vice-director, of the Central Meteorologico-Magnetic Observatory, the monthly summaries of Mexican data are now communicated in manuscript, in advance of their publication in the *Boletin Mensual;* an abstract translated into English measures is here given in continuation of the similar tables published in the MONTHLY WEATHER REVIEW during 1896. The barometric means have not been reduced to standard gravity, but this correction will be given at some future date when the pressures are published on our Chart IV.

Mexican data for November, 1897.

Stations.	Altitude.	Mean barometer.	Temperature. Max.	Min.	Mean.	Relative humidity.	Precipitation.	Prevailing direction. Wind.	Cloud.
	Feet.	*Inch.*	° *F.*	° *F.*	° *F.*	%	*Inch.*		
Arteaga (Coahuila)...	.....	.....	86.7	32.0	63.0	.....	0.28	.....	.....
Barousse (Coahuila)	5,414	.....	79.7	48.2	62.2	.....	T.	.....	.....
Colima (Sem.).....	1,636	28.28	93.4	57.4	75.9	74	0.05	wsw.	sw.
Durango.....	6,241	24.10	85.1	28.4	60.6	40	0.98	sw.	sw.
Leon.....	5,934	24.36	79.5	34.9	61.2	49	0.05	s.	.....
Magdalena (Sonora).	4,948	.....	.....	.....	64.4	.....	T.	w.	n.
Merida (Yucatan) ...	50	29.99	95.0	59.7	75.9	77	4.05	ne.	e.
Mexico (Obs. Cent.)..	7,472	23.12	73.8	39.2	57.7	60	0.30	nw.	ne.
Monterey.....	1,626	28.34	91.4	41.0	66.4	63	3.22	e.	se.
Morelia (Seminario)..	6,401	24.02	78.8	41.7	61.5	64	0.13	ssw	w.
Oaxaca	5,164	25.12	84.2	40.6	66.2	60	0.32	nw.	ne.
Puebla (Col. Cat.)	7,112	23.39	79.5	31.1	63.0	55	0.43	ne.	.....
Queretaro.....	6,070	24.25	78.4	37.9	61.3	55	0.03	e.	.....
Saltillo (Col. S. Juan)	5,399	24.93	81.0	41.5	61.2	62	0.08	sw.	n.
San Luis Potosi	6,202	24.21	75.6	41.5	59.2	64	0.07	ne.	se.
Silao (Guanajuato)..	6,063	24.35	74.3	46.4	63.3	59	0.01	ene.	sw.
Toluca (Mexico).....	8,612	22.00	.....	.....	.....	55	1.07	ene.	ese.
Torreon (Coahuila) ..	3,720	.....	83.1	50.2	63.1	.....	0.00	.....	.....
Tuxtla (Chiapas).....	1,864	28.17	92.8	54.7	75.0	71	0.04	nw.	nnw.
Vaqueria (Coahuila)..	.....	.....	85.3	32.0	59.7	.....	0.16	.....	.....
Zacatecas.....	8,015	22.58	77.0	39.0	58.8	57	0.54	e.	e.
Zapotlan (Jalisco)...	5,078	24.99	81.7	47.1	67.6	58	0.29	se.	sw.

BRIGHT METEOR.

By H. A. HAZEN.

On November 3, 1897, at 21:15 (9:15 p. m.) eastern standard time, a very brilliant meteor (nearly half the apparent diameter of the moon) was seen in Washington, D. C., due west from the corner of Massachusetts avenue and Tenth street NW. Its course was vertically downward for about 12°, disappearing at 15° above the horizon. The path at first was narrow, then came a series of dashes, followed by a continuous streak, constantly increasing in brilliancy till it flashed out extremely bright and whitish, when it instantly disappeared. The point of greatest brightness and disappearance formed the lowest apex of an almost equilateral triangle with Vega, Alpha Lyræ, and Altair, Alpha Aquilæ, though a little nearer the latter.

MILTON G. RENOE.

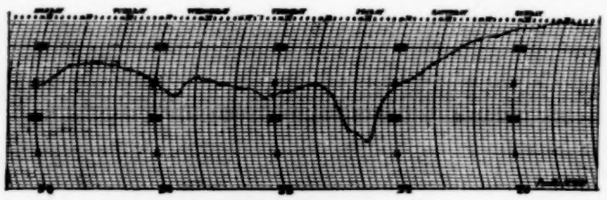
Milton G. Renoe was born at Manassas, Va., and was educated at Brentsville Academy near Manassas and subsequently at the University of Virginia at Charlottesville. Before entering the Weather Service he was a teacher in the public schools. He enlisted in the Signal Service (now Weather Bureau) on May 23, 1889; was promoted to 1st class private June 10, 1890; in July, 1891, he (with others) was transferred to the position of Observer, Weather Bureau, by virtue of the act transferring the Weather Service from the War Department to the Department of Agriculture. Shortly after July, 1896, he was again promoted and assigned to duty as official in charge of the station at Cheyenne, Wyo., as well as Director of the Wyoming Section of the Climate and Crop Service. Prior to his assignment as official in charge at Cheyenne, he had served as assistant at the following named stations: Baltimore, Albany, Savannah, and Philadelphia. He was an especially careful and painstaking person, and during his connection with the service was five times commended for accuracy in his meteorological work. He died at Cheyenne on the evening of December 16, 1897, at the age of 35. His services in the Weather Bureau distinguished him as a highly valued employee.

A WINTER BAROGRAPH CURVE FROM THE SOUTH PACIFIC OCEAN.

By ROBERT DE C. WARD (dated Harvard College Observatory, Southern Station, Arequipa, Peru, S. A., October 1, 1897).

Barograph curves from the southern oceans are comparatively so rare that they possess a considerable degree of interest under any circumstances. That interest naturally increases if the record represents the pressure conditions registered during a particularly stormy period, and which are remarkable by reason of their sudden changes or other peculiarities. The accompanying plate is a reproduction of a barograph curve obtained during a winter voyage recently made by the writer through the Strait of Magellan and up the west coast of South America as far as Corral, Chile (latitude 39° 52′ S.; longitude 73° 17′ W.). The instrument, a small sized Richard Freres barograph, was hung by a spiral spring from the ceiling of the stateroom, and was prevented from excessive swinging during rough weather by three cords tied to the handle of the instrument and made fast to hooks fixed at convenient distance in the walls. This method of swinging the barograph was found to answer very well, and a continuous series of excellent curves was obtained on the writer's whole voyage from New York to Peru, by way of Rio de Janeiro, Montevideo, the Falkland Islands, and the Strait of Magellan.

The sheet here reproduced was put on the barograph at noon on Monday, August 2, 1897, when the steamer (the *Luxor*, of the Kosmos Line) was in the Strait of Magellan about 20 miles east of Punta Arenas, and it was removed at 8.15 a. m. on Monday, August 9, when the ship was at anchor in the harbor of Corral. The greater part of the week was exceptionally stormy and the pressure curve is so striking that the writer has thought it might interest the readers of the MONTHLY WEATHER REVIEW to see a reproduction of it.



Tracing from the Richard barograph for the week from Monday, noon, August 2, to Monday, 8 a. m., August 9, 1897, on the steamship *Luxor*, between Punta Arenas and Corral, Chili.

The following record of the weather experienced during the week in question, although unfortunately very incomplete as regards instrumental data, may be sufficiently full to enable those who care to do so to examine the barograph trace intelligently.

Monday, August 2.—The morning was stormy, with frequent snow and rain squalls, wind west-northwest, the velocity reaching 35 miles an hour during some of the squalls. At 8.30 a. m. the temperature was 38° and the sky was nearly overcast with nimbus clouds. About noon (temperature 42.1°, clouds strato-cumulus, $\frac{5}{10}$) the wind changed to the south, with a velocity of 45 miles, and the sky cleared rapidly. The barometer, it will be noted, rose during the afternoon and evening, and until about 5 a. m. on August 3. The wind died down toward sunset, and the early part of the evening was clear and calm. At 10.15 p. m. the ship left Punta Arenas for the west, the weather being fine and the wind southwest, force 3.

(It should be noted that the irregularity in the pressure curve shortly after 9 p. m. was due to an accidental jarring of the instrument.)

Tuesday, August 3.—At 4 a. m. the wind was west, force 3, and it blew steadily from west-northwest, force 4 to 7, from shortly after 4 a. m. until about 4 p. m. The force increased during the day, and after 3 p. m. was between 7 and 9. Frequent rain or snow squalls continued all day and night. At 8 a. m. the temperature was 43.2°; wind velocity 25 miles an hour; clouds, nimbus 10. At noon the temperature was 45°, and the velocity of the wind 30 miles. As the wind was in-

creasing rapidly, and as navigation through the narrow channel of the strait was becoming dangerous, owing to the presence of low fracto-stratus clouds and to the coming on of darkness, the captain decided not to venture out into the Pacific until morning. The ship was therefore anchored at 4:15 p. m. in Sholl Bay, near the western entrance to the strait. The wind blew all night from north-northwest or northwest, force 3 to 10, with frequent heavy rain squalls. The gusts of wind, "williwaws," rushing down from the mountains and over the ship are clearly to be detected on the barograph curve, especially between 6 and 8 p. m., the rapid oscillations of pressure there shown being due to the suction effect of the different gusts. It will be noted that the barograph fell from early on Tuesday morning through the afternoon and night, and shortly after 5 a. m. on Wednesday.

Wednesday, August 4.—From midnight to about 6 a. m. the wind continued to blow from north-northwest, force 3 to 10, with frequent heavy rain squalls. About 6 o'clock it changed to west-southwest, and remained in that quarter until about 1 p. m., the force decreasing from 10 to 6, with continued squalls. As the barometer was rising rapidly after 5 a. m., and especially so after 7:30 a. m., there seemed promise of fine weather; so the anchor was weighed at about 8 a. m. and the ship headed for the Pacific. At 8 a. m. the temperature was 42.0° and the sky was overcast with nimbus. At noon, when off Cape Pillar, the temperature was 43.9° and the velocity of the wind 42 miles an hour, the sky being still overcast and the sea very rough. Occasional breaks in the lower clouds shortly after noon showed blue sky above, and there seemed chances of clearing weather. Between 1 and 4 p. m. the wind increased in velocity somewhat, the force being between 7 and 8 and the direction west to west-northwest, continuing so till 4 a. m. of August 5. At 4 p. m. the velocity was 45 miles an hour, the temperature 43.0°, squally, with blue sky at intervals. The change in wind direction to west at 1 p. m. was coincident with a renewed fall of the barometer, as seen on the curve, which continued through the night and until 9 a. m. on Thursday.

Thursday, August 5.—Until 4 a. m. the wind continued west-northwest, force 8, with frequent rain squalls, and from 4 to 8 a. m. it was northwest, force 8, the barometer showing an increased rapidity of fall after 5.45 a. m. until 9 o'clock, when the pressure began to rise. The wind was northwest or west-northwest the rest of the day, the force decreasing toward night from force 6 to 8 to force 3 to 6. Heavy rain squalls continued during the whole of the twenty-four hours.

Friday, August 6.—The barograph curve between midnight on Thursday and midnight on Friday is especially interesting. The fall began about midnight on Thursday and continued very rapid until about 10 a. m. Friday, when it decreased somewhat, reaching the lowest reading, 28.68 inches, shortly before 4 a. m., after which the pressure rose very rapidly for about ten hours, and then more slowly, the rise continuing during the remainder of the week. The fall amounted in eight hours to 0.65 inch, and the total fall, in fourteen hours, to between 0.75 inch and 0.80 inch. The rise was, in the first ten hours, 0.80 inch, and in forty-two hours 1.60 inch. From midnight to 3 a. m. the wind was west-northwest; at 3 it changed to north-northwest, force 5, and continued veering till it reached east by north, force 3 to 5, and, later, force 5 to 7. From 8 to 9:30 it was east by north. At 9:30 the wind changed to east-northeast, force 7, with sky overcast and heavy rain. At 10:25 the wind fell calm, and then, at 10:40, suddenly blew from northwest, force 3. The clouds broke away somewhat during the calm, but the sky clouded up rapidly again with the northwest wind. During the calm the upper clouds (alto-cumulus) were seen coming from the northwest. The wind continued northwest, force 2 to 5, until about 3 p. m. At noon the temperature was 50.5°, and the sky was $\frac{6}{10}$ covered with alto-cumulus above and fracto-nimbus below. After 3 p. m. the wind became light and variable, and at 3:30 it blew from the south, force 1. At 4 p. m., when the barometer showed its sudden rise, the wind increased very rapidly in velocity, until, by 4:30, it had reached storm force (11), with a very high and confused sea. At 8 p. m. it was south-southwest, and about midnight changed to west-southwest, decreasing in force from 8 to 6, but with continued heavy squalls.

Saturday, August 7.—During the early morning there were frequent squalls, accompanied by hail, with the wind west-southwest to southwest all day and night, but the force of the wind steadily decreased. At noon the temperature was 45.4°; the clouds were cumulo-nimbus, from northwest, $\frac{5}{10}$, and clearing. At 4 p. m. the wind velocity was only 12 miles; the temperature was 47.0°; and the clouds were cumulo-nimbus, $\frac{4}{10}$.

Sunday, August 8.—The weather was squally, with rain in the morning; wind west-southwest and south-southwest; force 1 to 2, but in the afternoon it cleared off and a deep blue sky, with scattered cumulus clouds and bright sunshine, was a most welcome relief after the dark and stormy weather of the four preceding days. At 11 p. m. the steamer anchored in the harbor of Corral, two days overdue from Punta Arenas. The next morning it was learned that the two preceding steamers from the south had both encountered very bad weather, with stormwinds and high seas, one of them having arrived at Corral three days late. The master of the *Luxor* stated that he had experienced no passage as bad as this one during his eighteen years of service on the west coast of South America.

The writer is indebted to Captain Behrmann, of the steamship *Luxor*, for extracts from the log of the steamer concerning meteorological observations made by his officers during the night. The wind force, as taken from the log, is given according to the Beaufort scale. The wind velocities, in miles per hour, were obtained by the writer with his Dines's Patent Pressure Portable Anemometer. The barograph was set to the ship's barometer, which had recently been adjusted in port. It is probable the error was not over 0.05 inch.

AN IMPROVED SUNSHINE RECORDER.

By D. T. MARING, Instrument Division, U. S. Weather Bureau (dated December 17, 1897).

The radiant energy of the sun produces several different effects at the surface of the earth, viz, *light*, *heat*, and *chemical changes*. To obtain records of these effects from hour to hour and day to day, as is done of other atmospheric phenomena, and thus obtain the total work done by sunshine, has been a most difficult problem for meteorologists, and one that has not yet been successfully solved. Automatic instruments have been devised for securing approximate records of the intensity and duration of each of these effects separately, but nothing has yet been perfected that will accurately indicate simultaneously the varying intensity of two effects such as the heat and light received from the sun.

Probably the first automatic sunshine recorder ever invented was that described in 1838 by Mr. Thomas B. Jordan, a mathematical and philosophical instrument maker, and Secretary to the Royal Cornwall Polytechnic Society, Falmouth, England.[1] This was developed in connection with Mr. Jordan's efforts to produce a uniform and automatic system of self-registration for the various meteorological instruments then in use in that country, especially the mercurial barometer. For a record chart he used a paper covered with chloride of silver, which had about that time (1838) been discovered to be sensitive to the action of light, and to take different tints in proportion to the intensity of the light to which it was

[1] See the Sixth Annual Report of the Royal Cornwall Polytechnic Society, 1838, p. 184.

exposed, provided the times of duration of the exposures were equal. This paper was mounted on an inclosed vertical cylinder moved by clockwork and was placed directly behind the top of the mercurial column of the barometer, so that the surface of the paper would be exposed more or less to the action of diffused sunlight through the glass tube, depending upon the variations in barometric pressure. The vertical time lines were printed on the sheet and, by means of opaque lines for inches, etc., graduated on the glass tube, the barometer scale, the fluctuations in barometric pressure, and the time and comparative intensity of sunlight were all automatically and indelibly recorded on the sensitized paper by the action of the light itself.

This apparatus certainly embodied some very ingenious ideas, and appears to have constituted not only one of the earliest forms of self-recording barometers, but contained also the first automatic register of sunshine. As Mr. Jordan makes no mention of the use of artificial light, it is presumed records from this barometer-sunshine apparatus were secured only during the hours of daylight, and his sample records, as engraved and reproduced in the report referred to,[1] are blank at night time.

Mr. Jordan's next attempt was to produce an independent instrument for sunshine alone, which he proposed to call "The Heliograph," a name more correctly applied subsequently to a very different form of apparatus. With this "Heliograph" he expected to obtain "an accurate account of the intensity of the light for every minute of the day, and to permanently register its indications." He describes his apparatus as follows:[2]

It consists of a light cylinder of metal, with a similar cylinder revolving about it, once in twenty-four hours, on a screwed axis. The inner and fixed cylinder is covered with a sheet of the prepared paper, and the outer or revolving one has a small hole in it, through which the light shines on the paper.

The axis of the cylinder and the position of the hole is so adjusted that the hole shall at all times be opposite to the place of the sun, and may, therefore, be considered as its picture traveling over the paper; it is found that the muriate of silver, with which the paper is covered, takes different tints, in proportion to the intensity of the light to which it is exposed, provided that the times of exposure be equal; and it will be seen that the mechanical arrangements just described will cause the hole in the outer cylinder to pass over the paper in a spiral line, every point of which will be illuminated for an equal time, and consequently its intensity at any given hour will be a correct representation of the intensity of light at that time, and the peculiarity of tint will show whether the sun were shining or obscured, and the degree of obscuration. The object of making the aperture to revolve in a spiral line is, that it may register the indications of a number of days on one sheet of paper without personal attention; each coil of the spiral will, of course, represent the light of one day, and the cylinder being driven by a clock (which may, at the same time, be employed for all the other instruments) the sheet when taken off will have eight parallel lines across it, correctly representing the light of the different days on which they were drawn, and will, together with the sheets from the other instruments, form a more perfect register of the state of the atmosphere for that time than could possibly be produced by the present mode of observation (1838).

An improved design of the above was brought out by Mr. Jordan in 1840,[3] which he describes as follows, under the title of "Description of a new arrangement of the Heliograph, for registering the intensity of Solar Light":

The instrument for this purpose, described in pages 185 and 186 of the last Annual Report of the Society, is obviously defective, in as much as it calls on the observer's judgment to decide the intensity of the light, by a comparison of the different tints given by it to the prepared paper, and does not therefore admit of any definite mode of expressing the results of each instrument, so that those at distant stations may be compared with each other; and in consequence of the changes which the different tints undergo in fixing (and subsequently to that process), however carefully conducted, it is not possible to make any useful comparison of results obtained by the same instrument at distant times. The object of the present arrangement is to avoid these difficulties, by reducing the indications of the instrument to a scale, so that the light of each day, or each hour, may be distinctly registered by it in a way that will not admit of any difference of opinion as to the reading, and which may be at once expressed by a *number* and tabulated with other meteorological observations. This, of course, does away with all occasion for fixing the sheets with the results on them, as they may be destroyed as soon as these results are known.

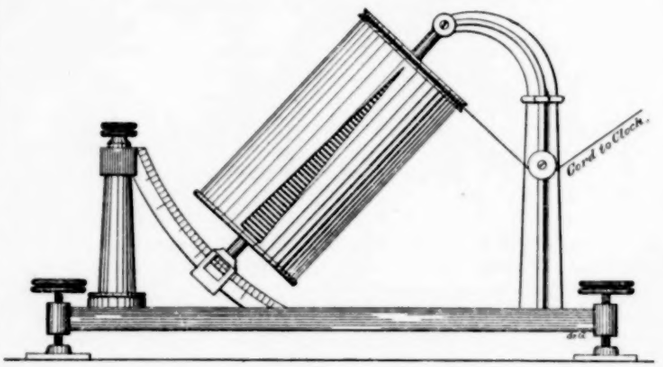


FIG. A.—T. B. Jordan's Sunshine Recorder (Heliograph), pattern of 1840.

The accompanying sketch (Fig. A)[1] is an elevation of the instrument. It consists of two copper cylinders supported in a metal frame. The interior one is fixed to the axis, and does not revolve, being merely the support of the prepared paper. The exterior cylinder is made to revolve about this one once in twenty-four hours by a clock movement. It has a triangular aperture cut down its whole length, as shown in the figure, and it carries the scale of the instrument, which is made to spring closely against the prepared paper. This scale, or screen, is composed of a sheet of metal foil between two sheets of varnished paper, and is divided into one hundred parts longitudinally, every other part being cut out, so as to admit the light to the prepared paper without any transparent medium intervening. The length of the extreme divisions measuring round the cylinder are proportioned to each other, as one to one hundred, consequently the lower division will be one hundred times longer passing over its own length than the upper one over its own length, and the lines of the prepared paper under these divisions will, of course, be exposed to the light for times bearing the same proportion to each other.

Now, as the sensitiveness of the paper can readily be adjusted so that the most intense light will only just tint it through the upper division during *its passage* under the opening, and the most feeble light will produce a similar tint through the lower division during *its passage*, the number of lines marked on the paper at any given time will furnish a comparative measure of the intensity of solar light at that time, and may be registered as so many degrees of the heliograph just as we now register the degrees of the thermometer. If it were considered desirable to compare the results of different instruments, of course it would be requisite that the scales should be exactly similar and the paper of precisely uniform quality.

Other modifications of this instrument were also made by Mr. T. B. Jordan, but, owing to the undeveloped state of photography sixty years ago, the records he obtained were not considered very satisfactory, and the instruments were found to be too expensive and unreliable for general use. At that early date there were, of course, no great national meteorological services in existence to take up and develop apparatus of this kind. It appears, therefore, that Mr. T. B. Jordan was the pioneer inventor in this field, and that his "photographic" sunshine recorders of 1838 and 1840 were the first of the kind used anywhere in the world prior to 1854.

Among the various forms of the so-called "sunshine recorders" that have been devised for measuring the time and duration of bright sunshine, one of the most important is that known as the "Burning" recorder, invented by Messrs. Campbell and Stokes of England, in 1854, and the improved form of the same designed in 1890 by Messrs. Whipple and Casella. These instruments have been used more or less extensively by foreign meteorological services since 1854,

[1] Ibid, Plate VII.
[2] Ibid, pp. 185–186.
[3] Seventh Annual Report, Royal Cornwall Polytechnic Society, 1839, p. 115.

[1] Ibid, Plate III, Fig. 3.

and operate on the same principle, that is, by concentrating the sun's rays through a glass sphere, acting as a powerful lens, upon a suitably ruled cardboard form, curved and held in focus at all hours of the day. But the degree of burning or charring of the line across this form or chart, for each day's record, gives only a very crude approximation to the thermal intensity of the sun's rays. The original "Burning" recorder, first designed by Mr. Campbell in 1854, used a glass ball filled with water as the lens; this was set within a round, shallow, mahogany bowl, having a radius such that the surface of the wood was constantly in the focus of the lens. This apparatus being placed where it could receive the sun's rays at all hours of the day, the wood was burned or charred into a series of irregular grooves around the inner sides, and the bowls were of such size and shape that each contained a six-months' record. Thus was obtained a very crude record of the duration and intensity of the heat effect of sunshine for semiannual periods, but this must have been so imperfect as to constitute but the roughest seasonal approximation. The water globe was soon found impractical and was replaced by a suitable solid glass sphere, but the wooden bowls were apparently continued in use for several years before being generally replaced by the more convenient cardboard forms invented by Whipple and Casella. Mr. James B. Jordan (not Thomas B.), in reporting to the Royal Meteorological Society on this subject in 1885, states also that at least one of these instruments using the wooden bowl was kept in operation at Whitehall, England, for several years, and that these curious and interesting original records (i. e., the bowls) were then in the possession of the British Meteorological Office at Kew.

The photographic sunshine recorder now used by the British meteorological service is that designed by Mr. James B. Jordan, in 1885. This makes a record of the time of duration of sunshine (actinic effects) on sensitized, blue-print paper. The same principle has been used for several years in the Weather Bureau photographic sunshine recorder, which is a constructional modification of Jordan's invention, and is shown in Fig. 1. In the Weather Bureau instrument, as designed by Prof. C. F. Marvin, in 1888, the sensitized sheets need be changed only once or twice a month, and a simple expedient is resorted to, in ruling the record sheets, to eliminate the effects of the progressive variations in the meridional altitude of the sun.

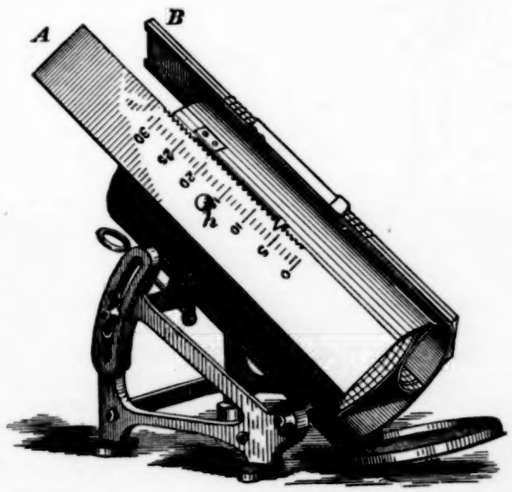


FIG. 1.—Photographic sunshine recorder.—Weather Bureau pattern of 1888.

In 1891, the present writer suggested a form of differential thermometer as a sunshine recorder, illustrated in Fig. 2, by means of which the presence of effective sunshine could be automatically and electrically recorded at a distance on the standard registers of the Weather Bureau, simultaneously with other data. This "thermometric recorder" has been

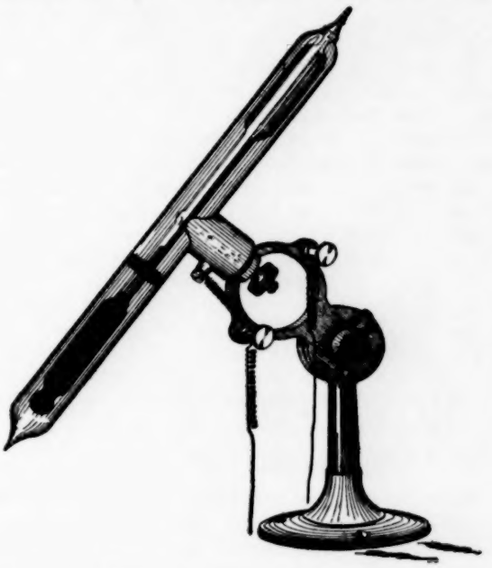


FIG. 2.—Thermometric sunshine recorder (pattern of 1895) mounted.

extensively introduced at the regular stations of the Bureau in the United States, and in connection with the photographic recorder shown in Fig. 2, is fully described in the pamphlet, W. B. No. 109, entitled "Care and Management of Sunshine Recorders." It is probable, however, that as in all other kinds of sunshine recorders, so now, the records obtained from this instrument at the various stations are not strictly comparable with each other, nor with those obtained from the photographic sunshine recorders, owing in part to the various different adjustments of the mercurial column that are unavoidable in an instrument operating upon this differential thermometer principle.

From careful comparative tests made in England, Mr. James B. Jordan decided that although his improved photographic instrument (using blue-print paper) registered, on an average, about 11 per cent more sunshine than the "Burning" recorder, yet there is no real antagonism in the records (each being valuable) for, while the former registers the delicate actinic effect, the latter gives only the grosser heat effect for a certain greater degree of intensity ordinarily known as "bright sunshine."

To record and tabulate simply the duration, in hours and minutes, of bright sunshine, as obtained by the above-mentioned sunshine recorders, and, as is now generally done by the various meteorological services throughout the world, does not give all the information desired relative to the sun's rays, nor all that is really required for a satisfactory study of this important element in meteorology. What seems to be really needed is a simple form of apparatus which will automatically and simultaneously record each of the various effects of radiant energy in such a way that the real varying intensities of all parts of the solar spectrum will be obtained in a satisfactory and comparable manner.

Our present knowledge of solar radiation (excepting the important work done by Crova at Montpellier with his self-registering solar actinometer) has been obtained from records secured by eye observations of several forms of actinometers, heliometers, bolometers, and bright and black bulb thermometers in vacua; but the observations were made

at such a very few points on the earth's surface, and for such comparatively short periods of time and have been interpreted by the help of such imperfect theories that the resulting percentages of solar radiation reaching the earth should not be accepted as final and absolute for all localities and under all conditions. It is believed that complete records of sunshine should be continuously and automatically secured at numerous points on the earth's surface.

The atmosphere has a large and constantly varying effect on the amount of heat and light received by the earth; the average intensity of the radiant energy when the sun is in the zenith is over 35 times greater than at sunrise and sunset. This constitutes one of the greatest difficulties to be met in any automatic instrument, for if the apparatus is to be *perfect* it should be sensitive enough to record the feeblest rays of sunrise and sunset, as well as the most powerful rays of the noonday sun. It is well known, from general meteorological observations, that the humidity as well as the temperature of the air is constantly changing; clouds are incessantly being formed and dissipated at various elevations; the circulation of the upper air currents is only imperfectly known, and, as all these elements affect the absorbing power of the air, we need an apparatus that shall be highly sensitive to sudden changes in order to give correct percentages of total sunshine.

These difficulties have, heretofore, been considered so insurmountable that no attempts appear to have been made thus far to design an instrument to automatically and continuously record the actual intensity of the whole of a sunbeam at the earth's surface, except indeed the very expensive and elaborate apparatus used by Langley at his astrophysical observatory in Washington, and that of Crova at Montpellier.

But all these difficulties should not discourage further efforts by those who have the best interests of meteorology at heart, and who desire to see it advanced to a more perfect science. It is believed that a suitable instrument is not a physical nor a mechanical impossibility, and, if such an apparatus can be secured, the matter of standardizing it, and of giving a number of them uniform and comparable exposures throughout the country, should not be insurmountable.

The writer has been experimenting in this connection for several years past, and, after numerous plans and suggestions had been tried, an instrument was finally devised which now gives promise of fruitful results. This is a combination of the principles contained in the two Weather Bureau instruments, the photographic and thermometric sunshine recorders, respectively, whereby the height of the column of mercury in the latter instrument is automatically recorded on a strip of photographic (blue print) paper.

The original working model is shown in Fig. 3, part of the outer cylinder being cut away to illustrate the method of operation. *A* is a circular brass case inclosing a strong 8-day clock movement and rigidly mounted on the adjustable metal support *B*. The clock turns the outer cylinder *C* (which is also of brass) once in twenty-four hours, and keeps the differential, bright and black-bulb thermometer of glass *D* constantly exposed directly toward the sun. The cap, *c*, closes the lower end of the cylinder *C* perfectly tight, and is held in place by friction. The cylinder itself is secured to the clock-pinion by the set screw, *s*, and is removed entirely when a new sensitized sheet is to be put in place. Directly behind the central stem of the differential thermometer a narrow slot is cut through the cylinder *C*, so that it will be completely covered by the mercurial column as it rises with the increasing intensity of sunshine. The strip of sensitized photographic paper is wrapped around the circumference of the part *A* and is held in place by suitable clips.

This apparatus is placed in a position where it will receive the sun's rays at all hours of the day and at all seasons of the year, the cylinder *C* being parallel with the axis of the earth. Ordinary blue-print paper is used, and is attached to the case *A* with the upper edge of the sheet under a fixed projecting piece of thin brass having the hours perforated therein and indicated by notches or holes at accurate distances apart. It will be seen that, as the cylinder *C* revolves with the sun, the instrument will automatically record its own time marks on each sheet. Furthermore, by stretching fine wires across the slot behind the mercurial column, the horizontal record lines for the scale of varying intensities of sunshine will be photographed in white, as indicated by the sample records reproduced herewith. The differential bright and black-bulb thermometer *D* is made similar to the present Weather Bureau thermometric sunshine recorder (Fig. 2), except that each bulb is in an independent vacuum. The glass tube is attached rigidly to the cylinder *C* and cemented in place so that the cylinder is water-tight. The weight of this glass part is counterbalanced by the weight *W*, so as to insure a regular rate for the clock.

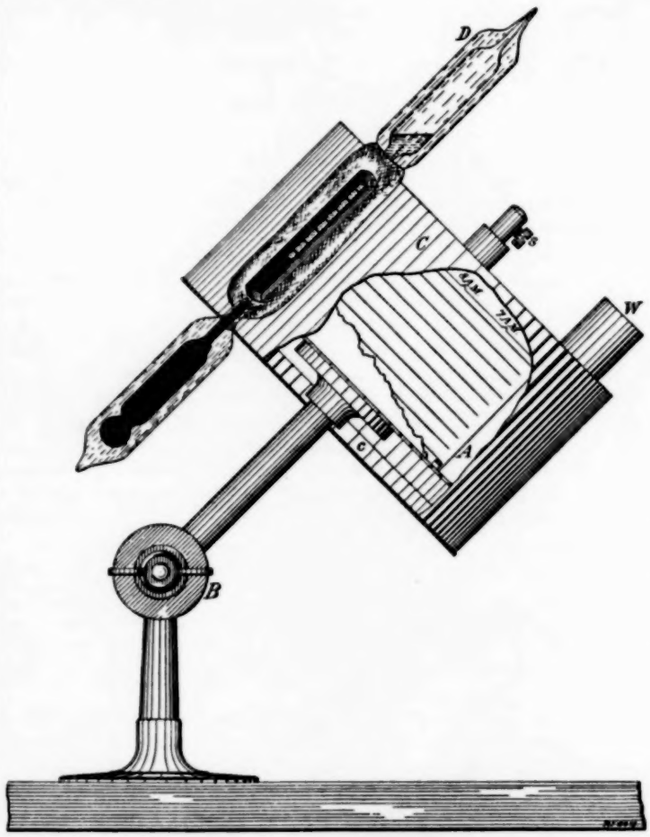


FIG. 3.—New photo-thermo recorder. (Maring's original working model of 1897).

By a coincidence, this apparatus must, in appearance, somewhat resemble the above-mentioned original sunshine recorder of 1838, although when designed in March, 1897, the writer had no knowledge of Mr. T. B. Jordan's device of sixty years ago.

This photo-thermo recorder is, of course, capable of being much improved as regards mechanical construction. Without adding much to its size or cost it can readily be made to produce an entire week's record, which is very desirable. The inexpensive American clocks are strong and sufficiently reliable timekeepers for the out-of-door conditions to which

an apparatus of this kind must necessarily be exposed. Still, if the clock is unsatisfactory the cylinder could be revolved by suitable mechanisms operated by electricity. The differential thermometer could also be made electrically recording, as at present, without interfering with the photographic record of intensity. One of the advantages of a photographic recorder operating on this principle is that the sensitized paper is securely inclosed and protected in a water-tight case, and the records can not be affected by rain and dampness, as in the present forms of these recorders. A more delicate and sensitive paper can therefore be safely used. Another advantage is that it uses the plain, blue-print paper, which can now be procured almost everywhere of dealers in photographic supplies, which paper is generally of far greater excellence than any that can be made in small quantities by hand.

Some sample records, by this process, of the time, duration, and intensity of sunshine (and cloudiness during daylight), are reproduced, as accurately as practicable in the accompanying illustrations, Figs. 4, 5, and 6, Chart IX. The corresponding descriptions in the appendix to this article give full details as to the conditions under which these records were made.

A sufficient number of comparative simultaneous observations with other apparatus has not yet been obtained to determine exactly the meaning of the varying intensities as given by this. In this model instrument the wires (*lines*, as shown on records) were arbitrarily placed equidistant apart, so as to approximately indicate differences of 5° F. in the readings of the standard bright and black-bulb thermometers in vacua. It was found afterwards, however, that the intensity of the heat and light effects of sunshine by this apparatus is by a *varying* scale of decreasing differences (between these thermometer readings) which scale has been estimated and is indicated approximately on the sample record for November 23, 1897 (Fig. 5).

These sample records are strictly comparable, as regards the angular adjustment of the mercurial column of the differential thermometer *D*, which was the same for all, and was not changed or altered while these records were being made.

As temperature has a slight effect on the mercury contained in differential thermometers of this form, and therefore on records produced thereby, a device could, perhaps, be made to automatically change the inclination of the instrument, and thus compensate for all temperature effects and cover the range from the maximum of summer to the minimum of winter. Something of this kind, that could be attached to the present form of electrical sunshine recorder, would be a valuable improvement.

Information relative to the intensity of solar radiation has been urgently needed for many years in the study of sanitary climatology and in investigations as to growth of crops and agricultural interests generally, and it is hoped this article may lead either to the perfection of present forms of sunshine recorders, or to the invention of something new that will furnish this important factor in our meteorological problems.

APPENDIX.

Figure 4.—*Photo-thermo sunshine record, September* 30, 1897. *Washington, D. C.*

Sunrise at 5:56 a. m.; sunset 5:44 p. m.; total possible duration of sunshine, 11 h. 48 min. Light smoke in morning to 7:30, and in afternoon after 4:30, interfered with twilight record, making indicated record of duration of sunshine only 10 h. 50 min. Weather unusually clear, warm, and cloudless; only two small clouds came between the instrument and the sun of about 5 minutes duration each, at 1:45 and 1:55 p. m. Winds very light and easterly. Minimum temperature, 45°, at 6 a. m.; maximum temperature, 83°, at 3 p. m. Maximum intensity of sunshine occurred at 1:30 p. m., although the intensity was nearly equal to this at 11:25 a. m., and at 12:45 p. m. Difference between bright and black bulb thermometers, same exposure, 35°.

Note the large variations in thermometric intensity on this record with apparently the same uniform conditions of sunshine, viz, cloudless sky, as shown by the photographic record.

Figure 5.—*Photo-thermo sunshine record, November* 23, 1897. *Washington, D. C.* (*Record for a part of the day, i. e.*, 7:50 *a. m. to* 2:40 *p. m.*)

Possible sunshine, 6 h. 50 min.; cloudiness, 2 h. 30 min., leaving 4 h. 30 min. as duration of sunshine. Weather cold and partly cloudy, with brisk to high northwesterly winds and scattering flakes of snow at 2:15 p. m. Maximum temperature, 46°, at midnight 22d; minimum temperature, 32°, at midnight 23d. The maximum intensity of sunshine occurred at 11:25 a. m.; black-bulb thermometer, in vacuum, maximum, 124°; bright-bulb thermometer, in vacuum, 99°; difference, 25°. Scale of varying intensities approximated, 0° to 43°.

Note the prompt decrease in thermometric intensity with the occurrence of cloudiness.

Figure 6.—*Photo-thermo sunshine record, December* 6, 1897. *Washington, D. C.* (*Record for a part of a day, i. e.*, 8:40 *a. m. to* 3:20 *p. m.*)

Possible sunshine, 6 h. 40 min.; cloudiness, 1 h. 20 min., leaving 5 h. 20 min. duration of sunshine. Weather cold and clear up to 1:40 p. m., when clouds began to form. Winds light to brisk northerly. Maximum temperature, 45°, at 3 p. m. Maximum intensity of sunshine at 12:50 p. m.; black-bulb thermometer, maximum, in vacuum, 110°; bright-bulb thermometer, maximum, in vacuum, 82°; difference, 28°.

The sudden decrease in intensity at 1:45 p. m., affecting the differential thermometer but not sufficient to affect the photographic record of sunshine, is very remarkable.

The time (hour) marks on this record were produced automatically, as already described.

ADDENDUM.

Since the preparation of the foregoing an opportunity has been presented of reading a summary of the proceedings of a recent meeting of the Royal Meteorological Society,[1] at which an interesting discussion was held relative to the comparative merits of the Campbell-Stokes Burning Recorder and the Jordan Photographic Recorder.

Mr. R. H. Curtis submitted a paper setting forth the history and description of these two forms of recorder, and gave the following conditions as requisite for a satisfactory comparison:

(1) Care must be taken that the instruments are in proper adjustment, and are fair examples of the types.
(2) They should occupy positions similar in every respect, and such as to give an absolutely clear horizon.
(3) The comparison should extend over a period sufficiently long to test them under varying seasons; and to detect any circumstance which might unfairly prejudice either instrument.

The records obtained from both instruments were measured independently by Mr. Curtis and three other gentlemen, all experienced in this particular work, but neither saw the compilations of the others nor knew what results had been obtained by the other instrument for the same day. The four values secured from the records for the twelve months, June, 1896, to May, 1897, both inclusive, were as follows:

[1] Symons's Monthly Meteorological Magazine, December, 1897.

Tabulators.	A.	B.	C.	D.
	Hours.	*Hours.*	*Hours.*	*Hours.*
Campbell-Stokes Burning Recorder	1,500	1,500	1,522	.....
Jordan Photographic Recorder	1,363	1,412	1,416	1,454

This shows a "personal error" in the tabulation of results from the burning recorder of only about 1 per cent, while for results from the photographic recorder the variation is from about 3 per cent to 7 per cent. This "personal error" is a refinement that has received little or no attention in the compilation of records from the Weather Bureau photographic recorders, but is shown by Mr. Curtis' experiments to be a very important matter. The Weather Bureau formerly kept a record for Washington by the burning recorder; the data has not yet been compiled but it would seem capable of being measured with a fair degree of accuracy.

As there may be differences of opinion and practice among Weather Bureau observers as to just how much of the photographic trace should be measured and tabulated, we note that Mr. James B. Jordan, in commenting upon this subject, states that it is wrong to ignore any trace, no matter how faint or indistinct. That the photographic recorder can not record too much sunshine, as the faintest trace is necessarily due to the sun's rays, and, as the washing reduces the faint traces especially, it is all the more desirable to tabulate everything.

Mr. Gaster stated that in England the photographic recorder was introduced because the burning recorder did not record the faintest sunshine, and that originally the traces from the photographic instrument were measured before being washed. The result was considered so large that comparison between records was impossible, and therefore washing was resorted to to make the records of the two instruments uniform. By using the better grades of blue-print paper it is not believed that the loss of records due to washing can be appreciable; and, with from 15 to 31 days record on each sheet, as obtained from the Weather Bureau photographic instrument, it is quite desirable to have the traces made permanent before compiling the data therefrom.

There was considerable discussion as to the deterioration of the glass used in the spheres of the burning recorders, due to chemical action, but this is a question that has not thus far been necessary to consider here, as there can be little or no effect of this kind that will impair the usefulness of the thermometric sunshine recorders used by the Weather Bureau.

Mr. Curtis' paper discusses at some length several questions, viz: How much of the trace on the sunshine records should be measured; the proper photographic chemicals; the effects of age on plates; and the effect of washing to fix the record. It gives 12-year records for the month of May at seven observatories, and shows the results of tabulations and the effect of personal equation.

[NOTE.—As the photographic recorder is apparently open to an uncertainty of 5 per cent, it is very desirable that Mr. Maring's combined photo and thermo recorder be put in operation at a few stations, in order to determine the degree of agreement between the two distinct and simultaneous records of this new type of instrument.—C. A.]

NOTES BY THE EDITOR.

THE KITE IN FRANCE.

At the meeting of the Meteorological Society of France, November 4, 1897, under the presidency of Professor Mascart, M. Teisserenc de Bort gave an account of the first results of the work that is being done by him at his "Observatory for Dynamic Meteorology" at Trappes, near Paris.

Since October 1, 1897, a self-register for pressure and temperature has been sent up at the Observatory for Dynamic Meteorology whenever the wind was strong enough to raise the kites. These ascensions became rather rare because of the season of calms which began about the middle of the month; hitherto they have been made by means of hexagonal kites furnished with tails and whose framework is made of aluminum. Teisserenc de Bort remarks that this style of kite is certainly inferior in efficiency to the American models, which will be adopted by him in the near future; but it is far easier to construct and, in its present perfected state, it possesses great stability; as to this latter point he finds that at small altitudes, 200 or 300 meters, in the great majority of cases, the displacement of the kite sidewise within a few seconds does not exceed its own apparent diameter. This result has been attained by changing the form of the tail, which is constructed of two rows of small bunches of paper, which are kept at a constant distance apart, about 35 centimeters (14 inches), by small bars of wood or aluminum. A cloth cone of about 25 centimeters (10 inches) in diameter at the large end forms the terminus of the tail; the whole reminds one of a clock pendulum of about 6 meters long. The whole tail weighs from 500 to 800 grams, according to the size of the kite.

The kite itself has about 3.2 square meters of surface with a weight of 1,700 grams, or 2 square meters with a weight of 1,200 grams. The presence of the tail increases the weight of the kite, and especially introduces a horizontal pull which depends upon the force of the wind; consequently, the ratio of the normal pressure of the kite to the horizontal pull is less favorable than in kites without tails, which latter, therefore, rise at angles greater than 45° in place of the 35° that ordinarily obtains in the case of the kites at Trappes. But one is able to utilize very nearly the same proportion of string as in the American kites and, thus, one can with 1,000 meters of string attain a height superior to 500 meters, because the curve taken by the string is much flatter. On the other hand, the tension being greater [when a tail is used] there is a greater chance of breaking the string.

M. Teisserenc de Bort mentioned some of the results obtained in his first ascensions, viz: The decrease of temperature with altitude varies very appreciably with the time of day; in the afternon the rate of diminution attains 1° C., for 120 meters; on the contrary, toward sunset, the temperature in the layers near the soil changes very little during the first 200 or 300 meters. The maximum altitude, 1,180 meters, was reached on November 2, 1897; this altitude was determined by triangulation.

Following the above communication the veteran meteorologist, Renou, expressed the desirability of a further development of these interesting researches. The President, Professor Mascart, took this occasion to congratulate Teisserenc de Bort upon the interesting works that he had undertaken at his observatory at Trappes. It is desirable that these observations, by means of kites, should be made as regularly and as continuously as possible, and should be supplemented by the use of a captive balloon on calm days, so as to obtain data as to atmospheric variations in the vertical above us for all kinds of weather. He urged Teisserenc de Bort to seek some practical method of establishing a captive balloon at a certain definite height, and insisted upon the fact that if a definite program, perfected in all its details, were at hand one would certainly find the financial means necessary for

its execution. In this respect Renou agreed with the words of Mascart.

M. Teisserenc de Bort thanked the President, Mascart, for the interest that he has shown, which would be a great encouragement to himself and his colaborers; he added that he already had a small captive balloon of about 40 cubic meters capacity, intended for preliminary experiments, but the cable has not yet been received; but in the course of last spring he had, by the aid of small models made of gold-beater's skin, made a series of researches on the best form for these aerostats, and hopes that he may, with patience, finally arrive at a practical solution.

LOCAL CLIMATIC CHANGES.

A correspondent in Northfield, Mass., desires our opinion on the question: "Were the winters of fifty or seventy-five years ago much colder, or were the snowfalls deeper than at present? The opinion is widely held that the winters were colder and the snowfalls deeper, but I can find nothing to warrant the belief except that in the first part of the century a much larger percentage of the population lived in the hill towns or in the interior, which are both colder than the valley or the coast towns."

On the general question as to appreciable changes in climate the Editor's opinion is that there has been no such change in any respect whatever so far as meteorology proper is concerned. If we divide our records of the weather recorded in North America since the days of Columbus into two periods, viz, before and after the year 1800, we shall find that every peculiarity, such as remarkable storms, winds, rains, floods, frosts, etc., recorded in the current century can be matched by a corresponding remarkable event before the year 1800. The popular impressions alluded to by our correspondent result almost entirely from the imperfections of our records and especially of our memories. There is a large class of persons whose habits of thought are so crude that when they experience any very remarkable weather they jump to the conclusion that the climate has changed, forgetting that they themselves have had such a limited personal experience that they are not fair judges of the weather over the whole country or of the climate of a century.

Our correspondent seems to suggest that a certain change in the habits of the people, such as the removal from the interior to the coast, or from forests to prairies, or from country to city, or vice versa, will partly account for widespread errors in respect to climate. The suggestion is excellent, but the Editor would be inclined to interpret the phenomenon somewhat differently. The general movement of the population in the past century has been from the Atlantic States westward, and from the country to the city, or quite opposite to the movement suggested by our correspondent. In fact, we find no real agreement in the so-called popular traditions with regard to the weather. We have met with quite as many persons who think the winters are more severe as with those who think the winters are less severe than formerly. Everything seems to depend upon how and where the "oldest inhabitant" lived when he was a boy as compared with his present condition. If he moved from a farm on a windy hilltop in the country down to a cosy house in the village, the climate seemed to him to have improved. If he moved from the milder climates on the coast in his youth to the severer climates in the interior he was, as a boy, struck with the great change, and the impression still remains with him that those winters were severer than now. If he has lived continuously in a large city like New York, where the growth of tall houses, the increased smoke, and diminished sunshine have completely changed the climate, and where these combined with the changes in the mode of living, especially the abolition of the open wood fire, have rendered the human system vastly more sensitive he finds that the inequalities of climate are greater than formerly.

From a hygienic point of view "the climate" includes everything that affects the health and comfort of the body. The meteorological climate that agrees perfectly with one person may be entirely too severe for another. Our remembrance of our physical sensations is not a safe criterion when judging of climate. Our remembrance of an occasional storm or winter is not a safe guide in comparing the past with the present. Our records of deep snows are too fragmentary to give anything more than a general conviction that there has been no material change in the snowfall. Our records of extreme low temperatures are liable to be in error several degrees by the ancient use of very imperfect thermometers and are almost certain to be exaggerated if the thermometers were placed in valleys or lowlands where cold air settles on still, clear nights, so that we must use great caution in interpreting these records; differences of 5, 10, and even 20 degrees have occurred between the minimum temperatures recorded by Weather Bureau and voluntary observers located within a few miles of each, owing to the combination of these two sources of error.

Remarkable rains and snows are usually quite local phenomena; there have been several remarkable cases of this nature in certain portions of New England and the Middle Atlantic States within the past ten years. Similar remarkable cases occurred in other portions of these States fifty years ago and equally remarkable cases occurred in still other portions just before 1800. If there has been any change in the climate of Northfield, Mass., it is because it lay within some one of these regions of extraordinary rain or snow on one occasion and not on another. Such a change of climate at one spot is no criterion by which to judge of changes at other places 100 miles away. The average climate of New England so far as the weather is concerned has not appreciably changed since the days when her oldest forest trees were young saplings, and that carries us back nearly five hundred years.

THE CELEBRATION OF THE SEMICENTENNIAL OF THE ROYAL PRUSSIAN METEOROLOGICAL INSTITUTION.

One of the evidences of the youthfulness of meteorology lies in the fact that so few institutions established to promote this branch of science have come down to us from ancient date. To be sure we have the famous Tower of the Winds, established in classical times in Athens, and the valuable meteorological records kept by Tycho Brahe at Uranianborg in his royal observatory on the island of Huena, in the Kingdom of Denmark. But these observatories have long since become obsolete, and all existing institutions for the promotion of meteorology, whether they are individual observatories or extensive weather bureaus, are of recent date. One of the early official recognitions of meteorology, as a matter of observation and record, was that made by the United States, when on April 29, 1817, Josiah Meigs, as Surveyor-General of the United States, asked for monthly records from the surveyors or registers of the Land Office scattered throughout what was then the western portion of our territory.

In the next year, 1818, Surgeon-General Joseph Lovell ordered the surgeons at military posts to keep regular records of the weather, in accordance with a suggestion made by Hospital-Surgeon Dr. Benjamin Waterhouse, and in continuation of a military order of May 2, 1814, which made it the duty of hospital surgeons to keep a diary of the weather. From that date until now the records of the Surgeon-General's Office have been maintained uninterruptedly and published in several successive meteorological registers.

On the other hand, the records of the Land Office, which were first published in Niles' Register, expanded into those of the Patent Office and the Commissioner of Agriculture, and eventually of the Smithsonian Institute, and were finally transferred to the Weather Bureau. Among the observers of the Medical Department of the Army was Assistant Surgeon A. J. Myer, who subsequently became Chief Signal Officer of the Army and Brigadier-General. He was the distinguished founder of the Weather Bureau and of the present system of storm and weather signals. But although the present Weather Bureau of the United States can thus trace the steps by which its climatological work developed from the seeds planted in 1814 and 1817, yet it will not for many years have a right to celebrate the fiftieth anniversary of its existence as a Government institution. Meanwhile we must congratulate our European colaborers on the early establishment of the existing meteorological systems of Belgium (by Quetelet in 1826), of the Netherlands (by Buys-Ballot in 1847), of Russia at St. Petersburg (by Kupffer in 1840), and Austria at Vienna (by Kreil in 1851). We owe to Humboldt the general stimulus that in the first half of this century pervaded all Europe in regard to the study of every branch of terrestrial physics. His influence was always given, directly and indirectly, toward the establishment of government bureaus, primarily for the collection of climatic and magnetic statistics, but eventually for the preparation of daily weather maps, the prediction of the weather, and the study of dynamic meteorology.

The recent brilliant celebration of the semicentennial of the Royal Prussian Meteorological Institution deserves to be brought to the attention of Americans, as emphasizing the distinguished recognition of science by the German Government. To the German mind, knowledge is science and science is power. In America there is a hazy uncertainty as to what constitutes science, but our citizens are certain that knowledge is money; therefore, our Weather Bureau, established for the purpose of forewarning storms, and thereby saving life, property, and money, is popularly supposed to be practical rather than scientific. But it would be a sad mistake to imagine that the Weather Bureau will be able, year after year, to respond to the steadily increasing demands for greater minuteness and greater accuracy unless the people give it the means to employ the best available talent in the study and discovery of the laws and combinations of laws that control the changes in the weather. The art of predicting is simply the application of the knowledge of the forecast official. If he knows only a few elementary generalizations, his predictions must be correspondingly indefinite. The more thorough his knowledge of the physics of the atmosphere, the better his predictions must be. Perfect art implies, necessarily, a higher science behind it.

At present no one has a satisfactory knowledge of the mechanical and thermal processes going on in the atmosphere. We are all learners. We, therefore, welcome the high recognition given in Germany to meteorological science as an evidence that that government is laying a sure foundation for future high attainment in the art of weather prediction.

The following account is abridged from an editorial article by Prof. Dr. R. Assman, editor of Das Wetter, a monthly meteorological journal, for November, 1897:

On the 17th of October, 1847, Frederick William IV, King of Prussia, signed the decree allowing the establishment of the Royal Meteorological Institute, the importance of which had been shown by Alexander von Humboldt in repeated addresses. On the 16th of October, 1897, the fiftieth anniversary of this day was celebrated in the most appropriate manner in the presence of their Majesties the Emperor and Empress of Germany and the two eldest of the princes.

The quarters occupied by the Meteorological Institute in the old Academy of Architecture, No. 6 Schinkelplatz, Berlin, are extremely limited and inconvenient and have long since ceased to respond to the official needs. On the other hand, at the observatory of the institute, lately erected on Telegraph Hill at Potsdam, there are no large rooms sufficient for a celebration of this kind. It was, therefore, necessary to go elsewhere, as guests, and accept the hospitality of the Royal Geodetic Institute, whose building, also erected on Telegraph Hill, offered a memorial hall in which a company of about one hundred and fifty persons could be accommodated.

The jubilee festivities were divided into three parts: An address in the Memorial Hall, a visit of inspection to the Magnetic and Meteorological Observatories of the Institute, and a banquet in the hall of the Palace Hotel in Berlin.

Shortly after 3 p. m. their Majesties and the Imperial Princes, accompanied by a brilliant retinue, arrived and found waiting for them a company composed of the highest Government officials and representatives of science, and also the son and nephew of the distinguished Dove, who for so long a time was Director of the Institute. After the festivities were initiated by singing the 23d Psalm by the men's Choral Society of Potsdam, the director of the institute, Professor von Bezold, delivered the memorial address, in which he sketched the activity of the institution during the whole period of its existence, showing the important part it had taken in the progress of science. The methods of investigation peculiar to climatology demand thousands of conscientious and accurate observers, but the study of averages and statistics also necessitates that the processes going on in the atmosphere can only become objects of earnest investigation a considerable time after they actually occur. The first director, Mahlmann, held that office only a short time and was succeeded by Heinrich Wilhelm Dove, who, without controversy, elevated this meteorological institute to the highest position among all similar establishments throughout the world at that time. After the German Empire had been founded and a central place for certain definite branches of investigation had been found for all German meteorology in the Seewarte (Marine Observatory) at Hamburg the necessity for reorganization of the Prussian Institute at Berlin became daily more evident, since it was evident that the exclusive statistical method that had been adopted there for many years could not lead to the desired end; the great development of the physical sciences demanded that they should control in the study of the atmosphere. Therefore, in the year 1885, the institute was greatly enlarged and adapted to its new problems by the addition of the appropriate men of science.

At the present time, in order to obtain fundamental material for climatological investigations there are 188 stations of the higher class, 1,336 thunderstorm stations, and 1,844 rainfall stations; scientific balloon ascensions on a larger scale than have hitherto been made also contribute material of the highest value for the study of the physics of the atmosphere. This material is reduced, analyzed, and discussed at the Central Institute in Berlin; the distribution of meteorological knowledge is provided for by instruction at the University, given by members of the staff; the experimental investigations are conducted at the Meteorological and Magnetic Observatory in Potsdam. This latter institution in connection with the astrophysical and the geodetic institutions on the same locality (Telegraph Hill) at Potsdam, inasmuch as each of these institutions carries out a special field of investigation, constitute altogether a microcosmos located, as it were, at a definite point on a line extending from the center of the earth outward to the stars; the work special to meteorology occupies a somewhat more limited field than that of the other two establishments.

At the close of the address the Minister of Education announced certain decorations to be given in connection with the Jubilee celebration. The great golden medal in science was presented to the Director of the Institute, von Bezold; the Order of the Crown (3d class) was given to Hellmann, as Chief of the First or General Division of the Central Institute; the Order of the Red Eagle (4th class) was bestowed upon Sprung, Chief of the Third or Instrument Division and Director of the Meteorological Observatory; the Order of the Crown (2d class) was given to Vogel, Director of the Astrophysical Observatory. It was especially pleasant to notice that a relatively large number of the friends of meteorology and the honored observers of the Institute received thanks for their patient labors. Among these, Professor Gruhn, of Meldorf, Professor Mohl, of Cassel, Professor Paszotta, of Konitz, the publisher, Alexander Faber, of Magdeburg, and, finally, Freidrich Treitsche, as proprietor of the Mountain Observatory, on Inselsburg, near Erfurt, received the Order of the Red Eagle (4th class).

After a final song the company made a tour through the Meteorological and Magnetic Observatory, examining in the most detailed manner the instruments and the building. In the evening most of the guests assembled at the banquet in Berlin. The Minister of Education gave a brilliant sketch of the activity of the Institute and the generosity of the Emperor in assigning special funds for the study of the upper atmosphere. Neumayer, the director of the Seewarte, at Hamburg, expressed the best wishes for the future of the Meteorological Institute. Von Bezold, director of the Institute, thanked the Government as well as his friends, the guests, for the honor which they had done him. Numerous addresses and telegrams of congratulation were received from all parts of the world. Among these, that from the Grand Duke Constantine, expressing the congratulations of the Imperial Russian Academy of Sciences, was most warmly received.

METEOROLOGICAL STATION IN TERRA DEL FUEGO.

Mr. Moses Y. Ransom, of Cleveland, Ohio, writes that he is about to establish a business plant on the south shore of Terra del Fuego, which will remain there about three years. He has already sent the Weather Bureau some records kept in this locality during the past year, and as the proper interpretation of these records requires some knowledge of the topography and surroundings of this locality we print the following description from Mr. Ransom's notes:

If you will examine the nautical charts of the Strait of Magellan, the waters of Terra del Fuego, and the isthmus to the south, you will see a large area of land and water that has no parallel on this globe, a country beyond 53° south latitude, with a temperature seldom below freezing point and yet never warm. Its high mountains reach up into a frigid temperature, while their bases are continually washed by the warm waters of the Pacific, resulting in an atmosphere that is too damp to dry a cotton cloth in the open air. There are channels of water in every direction, 1 to 3 miles wide, fiords cut perpendicularly down from the summit to the water level, 3,000 to 4,000 feet, and then, below you, there are still from 10 to 300 fathoms of water. All over this section, particularly to the westward, are elevations rising to 4,000 and occasionally to 8,000 feet. There are thirty to fifty great glaciers, and all around below them the beech trees and the tropical magnolias, which are evergreens here. In some places grass grows on decayed grass roots all the year round, and so long has this endured that there is frequently an accumulation of wet, decayed vegetable matter under these roots. You can push a bamboo pole down 16 feet. The tidal rise and fall is 40 feet at the first narrows in Magellan Strait; 60 miles farther in the tide rises from 4 to 6 feet; in the southern channels, practically no tide, but a current, apparently driven by the wind. The albatross, the penguin, the parrot, and the canary bird live here. The barometer falls with a wind from southwest for one day and then rises with a gale from the southwest a few days later; and the same may be said for winds from every other point of the compass. I had my yacht hove to, riding out a heavy gale of wind off Cape Horn Island for four days. On my return to the station, only 60 miles northward, I found that they had had continued good weather on the land and no evidence of a gale 60 miles away from them. I can get no position on the land that the winds are not controlled in direction by the high mountains and valleys. Good observations of the clouds are generally obscured by the masts and rigging above us. I can not take temperature by the wet and dry bulb, for both of them are constantly wet. There are but few days when we can get the true temperature of the ocean; the surf is so tremendous that you can only catch a part of a pint of water high up on the beach.

RECENT EARTHQUAKES.

Prof. Edward W. Morley of Adelbert College, Cleveland, Ohio, reports that his seismograph showed no earth tremor during the current month. The same may be said of the Marvin seismograph at the Weather Bureau in Washington.

On November 4 a severe shock of earthquake was reported at 2:29 a. m. over portions of Idaho, Montana, and Utah. The shock was especially severe at Dillon. A second shock was felt, but not so severely, over the same area at 7 a. m.

On Sunday, October 31, about 4 p. m., a mysterious detonation shook the ground at Niles, Mich. It is by no means certain that this was due to an explosion of gunpowder, as at first supposed, or to an earthquake. It frequently happens that noises and vibrations, and the destruction of window glass are produced by the passage of great meteors which are, themselves, hidden by clouds or the bright sunshine, and this may easily have been the case at Niles.

WEATHER BUREAU STATION ON MOUNT TAMALPAIS.

In the September number of the MONTHLY WEATHER REVIEW the reader will find the first report of Mr. W. H. Hammon, forecast official at San Francisco, on the results of meteorological observations made during his recent stay on the summit of Mount Tamalpais. His observations and conclusions satisfactorily demonstrated the probable usefulness of that station in weather forecasting, and it was his report only that justified the Chief of Bureau in deciding to recommend to the Secretary of Agriculture that the Bureau incur the expense of a permanent establishment at that point. It was necessary to have this positive report from an experienced forecast official before the establishment of such a station could be decided upon. In former years Mount Washington, Pikes Peak, and Mitchells Peak were all occupied by the Weather Bureau as mountain stations, hoping thereby to directly increase the accuracy of the forecasts, besides also adding to our knowledge of the phenomena of the upper atmosphere; but in the progress of time exigencies arose that demanded the surrender of these stations, and regrettable as that was from the point of view of the student of meteorology, yet it must be confessed that the daily forecasts did not suffer therefrom. When, therefore, petitions and letters from the citizens of California were received, urging the establishment of the Tamalpais station as a popular desideratum, the first inquiry naturally was, "Will this station be sufficiently advantageous to the forecaster to justify its maintenance?" and that question could only be answered by allowing Mr. Hammon to occupy it for a sufficiently long time. The phenomena that he reported from the summit were the first that the Weather Bureau had received directly bearing on the question of weather predictions for California from local indications of temperature, wind, and sky, as compared with general indications furnished by the barometer and the daily weather map.

It is true there was on hand a report from Prof. George Davidson, the distinguished representative of the Coast and Geodetic Survey, urging the value of the station from a general meteorological point of view and as a lookout for telegraphically announcing passing vessels, which are hidden by the fog within the Golden Gate; but this was not quite the point of view of the Weather Bureau forecast official. Mr. Davidson occupied the Coast Survey station on Tamalpais from December, 1858, to March, 1859, and again from July to September, 1882. In 1883 he urged the establishment of an observatory, and interested Mr. William T. Coleman, of San Francisco, in the project. They secured funds and built a wagon road to the summit of the mountain. The land, the house, and the telegraph line were provided for, when, suddenly, some one opposed the project and frustrated all further efforts. Professor Davidson's report says:

The great obstacle to the free and unrestricted navigation of our coast and of the entrance to San Francisco harbor is the prevalence of fogs. During the months of July, August, and September, 1882, these fogs were extremely persistent from the Golden Gate seaward to and beyond the Farallones. In the neighborhood of Point Reyes there has been as long a period as thirty-nine days of continuous fog.

During the other months there is much fog, and sometimes it is continuous and very dense. From observations directly on Tamalpais, and also from surrounding mountain tops, I have found that this fog cloud attains an average height of 1,400 or 1,500 feet above the sea; but it sometimes rises so high as to envelop the summit of Tamalpais. In all ordinary fogs the observer on the mountain will occasionally see the fog dissipate along the immediate shore line in the greatest heat of the day, and close up again at night. Sometimes he sees the Golden Gate blocked by fog far beyond the Heads, and large areas of the Gulf of the Farallones clear of fog, with vessels here and there that could see nothing but the mountain. At times the southeast Farallone will be covered, and large areas free; so with Point Reyes. Then, again, the Farallones and Point Reyes will be clear, but fog nearly cover the Gulf. My experience clearly indicates that the locality of the maximum fog in the Gulf of the Farallones lies between the Heads and Point Reyes, and this is confirmed by the record for fog signals. The fogs at the Heads are much more frequent than at the southeast Farallone. In 1883 the average monthly record of the fog signal at that island was ninety hours, and one hundred and fifty-four hours at Point Bonita.

In the areas of partially dissipated fog in the Gulf and in the Golden Gate I have seen the mastheads of vessels above the low-lying fog, in which their hulls were invisible; so that a lookout at the masthead could have certainly gotten the direction of Tamalpais. Moreover, a signal officer on the mountain could have known her signals. Of course, there are times when the mountain top is covered with a cloud cap while all below is moderately clear. This condition usually precedes southeast weather and does not arise from fog. Telephonic communication with the city station would cover such infrequent cases.

Throughout the year the broad outlook from Mount Tamalpais will help the signal officer, because he is not hampered by the local and

unfavorable conditions of the city, and because he can see conditions of the atmosphere far to seaward and far along the Sierra Nevada to the southeast and northeast that are unknown to the city station. At the Sierra Nevada geodetic stations the observer can usually predict, from his observations, the weather for two days in advance.

From the station on Tamalpais notices of vessels could be given in clear weather when they are on the horizon 60 miles distant and directly seaward, or far to the southward, or to the northwestward, even beyond and over the lowlands inside of Point Reyes. And even when the vessel is only seen in some small open patch, an observation on her from the station for direction and depression would give an approximate position which could be telegraphed to the city for information or assistance. And in heavy southwest weather the condition of the bar when breaking, or the danger of some vessel could be promptly made known to the city.

This letter and attending reports were sufficient to justify Professor Moore in his determination to give every opportunity for a full investigation of the merits of this station and, if worthy, to give his hearty support to the projected new mountain observatory. Petitions from the citizens of San Francisco in October, 1896, were followed by immediate action by Hon. J. Sterling Morton, then Secretary of Agriculture, who ordered that—

The necessity of instituting the station be given careful consideration, bearing in mind that stations are made for the good of the Weather Bureau service, which is intended to be strictly utilitarian; therefore, neither personal nor political influences are to be considered when new stations are proposed or other innovations suggested.

The investigation made at that time did not suffice to overcome the objections as to expense and the uncertainty as to the possible value to the forecaster of a station on Mount Tamalpais.

On May 20, 1897, Mr. W. H. Hammon, Forecast Official, reopened the question and offered to contribute his own time, viz, his annual vacation leave and a considerable part of the expense if he might be allowed to occupy this station and, by personal experience, determine its desirability. His offer was accepted, the necessary apparatus was secured, and on July 10 Mr. Hammon was assured by the Chief of Bureau that—

It is believed, therefore, that whatever is done in this direction should be well done, and that the instruments and apparatus should be carefully installed with a view to obtaining the best possible results; but it must be distinctly understood that you are to use your own judgment as to the amount of time and work you can expend in connection with this new station, as work of more immediate and pressing importance demands your attention, namely, the inauguration of a more efficient climate and crop service for the State of California. The fact that your numerous requests for increased expenditures and for additional assistance have not been complied with should not be taken as an evidence that the Central Office does not appreciate your work or that it does not wish to honor all reasonable recommendations which you make. The fact is, that during several years past there has been no increase in the appropriation for the support of the Weather Bureau, while the amount of work has vastly increased. This makes it absolutely impossible for the Chief of Bureau to exceed a certain limit of expansion and development.

These conditions are thus made plain, so that you may not misunderstand the attitude of the Central Office, and so that you may be in a position to assist rather than to embarrass the Chief of Bureau.

It is presumed that you have fully considered the amount of work that will be required of your station in connection with the transfer of climate and crop service from Sacramento, and that you still believe you can care for this additional station.

It is desired that you temporarily establish the station on Mount Tamalpais, and after a reasonable time make a definite report as to the value of the observations in assisting you to make better weather forecasts. If it can be shown that the observations are of sufficient importance an increase in our present appropriations will be asked of Congress in order to enable the permanent establishment of the station.

Mr. Hammon occupied the new station during the whole month of September and made two reports, i. e., one on the value of the station, which was published in the September REVIEW, and one on the location of the temporary station, which we publish in the present REVIEW, together with the accompanying chart showing the relation of Tamalpais to the surrounding region.

Mr. Hammon's report on the value of the station was convincing to the Chief of Bureau, who, in congratulating him, said:

I have been very much pleased with your report, which is lucid and valuable. Your investigation has convinced me of the utility of placing an observatory on this promontory and it is regretted that we have not the means to at once take up this work. If the estimated increase in our appropriation is given for the fiscal year beginning July 1, 1898, you can expect to have the station established according to the plan outlined in your report of September 30, 1896, * * * and that one observer be permanently detailed for work at the mountain station and that he be in telegraphic communication with the San Francisco office, and that the mountain station be considered as a part of your own.

Excellent suggestions are often received by the Chief as to probable and possible and hypothetical improvements in the Weather Bureau service, and this present history simply presents one more illustration of the general principle that such suggestions are not sufficient in and of themselves, but the authors must establish the fact that the suggestions are really valuable as increasing the utility of the service.

REPORT ON THE LOCATION AND ELEVATION OF INSTRUMENTS AT MOUNT TAMALPAIS, CAL.

By W. H. HAMMON, Forecast Official (dated September 25, 1897).

The region about Mount Tamalpais is shown on the accompanying chart, No. VI. There are three peaks in an east and west line, the extreme eastern one being about 1½ mile from the extreme western one. The eastern peak is 2,592 feet in height; the western one about 2,620, and the middle one, equidistant from the other two, is about 2,500. The saddles between these peaks have elevations of between 2,200 and 2,300 feet. The surface slopes very abruptly from this ridge to less than 1,000 feet within a mile and in almost every direction, the slope being much more abrupt from the eastern peak, the the summit of which is but a sharp point, except for a ridge about 100 yards long, extending to the southwestward. From this eastern peak, where the wind vane is established, the surface slopes to an elevation of 100 to 300 feet within 2 miles in every direction, except toward the west, and on that side it drops to the saddle, 250 feet below and about 1,000 feet distant. This peak is, therefore, an isolated cone, rising nearly half a mile above the entire surrounding region, with the exception of the west, where, perhaps, 30° of the horizon are obstructed by the two other peaks. A thermometer shelter may be placed above ground on a knoll, about 20 feet high, to the west of the hotel. For the present, however, a "cotton-region shelter," placed in the shade of the deep veranda on the west side of the hotel, is satisfactory. The tavern of Tamalpais is 800 feet from the flagstaff on the summit of the eastern peak and 240 feet below it. The anemometer is on a support in the place formerly occupied by the flagstaff, but the self-register is kept at the tavern, and a connection is made by a telegraph cable about 1,000 feet long.

The wind vane and anemometer are mounted upon a combined shaft, 18 feet long. This is placed upon the topmost rock of the eastern peak of the mountain. The shaft, being hollow, was set over an iron flagstaff 1¼ inch in diameter, which had been previously leaded in the rock, and was cut off about 2 feet above the rock. After setting the shaft over it, cement was run into the hollow shaft, filling the space between them. The guy rods were leaded into holes drilled into the rock. The shaft is perfectly stable and unusually free from vibration. The rock is 2,592 feet above sea level (Coast and Geodetic Survey), thus making the vane 2,610 feet above sea level and the anemometer cups about 1 foot lower.

The surface slopes downward from the point where the shaft is erected at angles varying from 10° to 40°. The vane is apparently free from all disturbing influences, and in brisk to high winds remains almost absolutely free from motion.

The thermometers are mounted in a "cotton-region shelter,"

which is spiked to a post of the porch at the west end of the Mount Tamalpais Tavern. The Tavern is 200 feet lower than the place where the wind vane is mounted and 800 feet southwest from that point. There is an excellent circulation of air about and through the shelter, and at the same time it is shielded from the direct solar rays. The bulbs of the dry and wet thermometers are 5.6 feet above the floor of the porch and about an equal distance below the roof. The wet bulb is arranged for a stationary hygrometer, with cup and wick attached. However, it is always well ventilated, by fanning, whenever a brisk wind is not blowing.

The rain gauge stands at the top of a gently sloping knoll in the broad saddle which separates the eastern peak from the middle peak. It is about 1,000 feet southwest of the eastern peak and 200 feet lower. It is 75 feet west of the pavilion connected with the hotel, the roof of which rises about 20 feet above the gauge.

The barometer is hung 18 inches east of the door of the office, which opens to the northward. There is a small window in the south wall opposite, but the window sill is 5 feet above the floor, consequently it gives the best light to the opposite side of the room. There is some doubt as to the elevation. The cistern is 4 feet above the bench mark of the railroad at the switch that is distant 50 feet north. This bench mark was found to be 210 feet below the bench of the Coast and Geodetic Survey, which is in the topmost rock of the eastern peak.

This bench mark bears the inscription "Elevation 2,592 feet." This makes the elevation of cistern 2,386. In applying corrections for elevation I have used the following:

Temperature.	Reduced to sea level.
50°	+2.48
60°	+2.43
70°	+2.38
80°	+2.33

I find these corrections give a reading 0.02 to 0.03 too high as compared with San Francisco when the temperature on the mountain is as low as that at San Francisco, but the reading is too low by 0.03 to 0.06 when the mountain temperature is 15° to 20° higher than in the city, as is frequently the case.

METEOROLOGICAL TABLES AND CHARTS.

By A. J HENRY, Chief of Division of Records and Meteorological Data.

For text descriptive of tables and charts see page 448 of REVIEW for October, 1897.

TABLE I.—*Climatological data for Weather Bureau Stations, November, 1897.*

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.										Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.					Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Mean actual, 8 a. m. and 8 p. m. + 2.	Mean reduced.	Departure from normal.	Mean max. and min. + 2.	Departure from normal.	Maximum.	Date.	Mean minimum.	Minimum.	Date.	Mean minimum.	Greatest daily range.					Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.					
New England.							40.9	— 0.8												6.46	+ 2.4										
Eastport	76	69	74	29.90	29.99	+ .02	36.2	— 1.2	55	6	42	8	24	30	27	33	30	80	5.79	+ 1.6	14	10,638	nw.	60	ne.	12	6	5	19	7.4	3.7
Portland, Me	108	81	89	29.90	30.00	— .01	36.3	— 1.5	57	4	43	11	24	29	31	33	29	78	6.69	+ 2.7	16	5,660	nw.	32	ne.	12	8	6	16	6.6	6.1
Northfield	872	15	59	29.08	30.06	+ .02	31.0	— 2.0	60	26	40	4	24	24	42	29	27	85	4.86	+ 1.6	16	6,970	n.	34	se.	26	3	7	20	8.0	8.9
Boston	135	115	181	29.92	30.06	+ .03	41.4	— 1.3	68	16	50	13	24	33	37	38	34	78	6.19	+ 1.6	15	8,662	nw.	46	nw.	12	7	6	17	6.8	8.1
Nantucket	14	43	54	30.06	30.07	.00	45.0	+ 0.4	64	6	50	21	24	40	22	42	38	78	3.90	+ 0.4	14	10,068	nw.	39	nw.	12	10	4	16	6.8	2.5
Woods Hole	.....	51	57	.....	.....	.....	43.4	— 0.9	64	2	49	17	24	38	19	.....	.....	.....	7.34	+ 2.5	12	13,769	w.	60	sw.	12	13	4	13	5.3	4.3
Vineyard Haven	.....	20	.....	.....	.....	.....	45.8	0.0	66	2	53	18	24	38	25	.....	.....	.....	6.42	+ 2.7	14	.....	nw.	.....	.....	...	8	7	15	....	4.1
Block Island	27	39	48	30.05	30.08	+ .02	44.7	— 1.0	63	2	50	18	24	40	22	42	38	76	9.42	+ 5.2	16	12,706	nw.	54	nw.	9	6	13	11	6.0	1.2
Narragansett Pier	.....	10	.....	.....	.....	.....	43.0	0.0	65	6	51	6	24	35	27	.....	.....	.....	8.25	+ 4.1	15	.....	nw.	.....	.....	...	10	7	13	....	10.0
New Haven	107	118	140	29.95	30.07	.00	41.9	0.0	64	4	49	15	24	35	33	38	34	76	5.72	+ 1.8	15	7,243	w.	42	w.	9	8	8	14	6.2	2.1
Mid. Atlan. States.							46.7	+ 0.1												3.65	+ 0.5										
Albany	97	84	113	29.98	30.09	+ .02	38.9	— 1.7	61	4	46	12	24	32	34	36	32	81	4.65	+ 1.7	17	6,691	s.	34	w.	12	1	12	17	7.8	4.5
Binghamton	875	79	90	.....	.....	.....	38.6	.....	66	4	47	11	24	31	36	.....	.....	.....	2.43	.....	15	6,035	w.	36	nw.	9	2	10	18	7.6	3.8
New York	314	298	326	29.75	30.09	+ .01	44.1	— 1.6	66	16	50	21	24	38	30	40	36	75	4.44	+ 0.6	13	10,859	nw.	54	w.	9	6	10	14	6.6	1.5
Harrisburg	377	94	102	29.72	30.14	.00	43.3	+ 1.0	68	2	50	26	30	37	26	38	32	69	4.09	+ 1.3	14	6,354	w.	48	w.	9	2	13	15	7.1	1.5
Philadelphia	117	108	184	29.99	30.12	+ .01	45.9	+ 0.8	71	16	53	24	24	39	30	41	36	72	4.44	+ 1.2	13	6,998	nw.	38	nw.	9	5	14	11	6.4	1.0
Atlantic City	52	68	76	30.07	30.13	+ .03	46.2	+ 0.3	64	2	53	22	24	40	26	44	41	84	4.04	+ 0.5	11	9,170	nw.	42	nw.	16	10	12	8	5.6	T.
Baltimore	123	68	82	30.00	30.13	+ .01	46.3	+ 0.8	75	16	53	27	30	39	31	41	35	70	4.39	+ 1.4	15	3,462	w.	26	w.	9	11	9	10	5.2	T.
Washington	112	59	76	30.03	30.15	+ .02	46.0	+ 0.4	76	16	55	26	24	37	33	41	36	75	3.31	+ 0.5	14	5,212	nw.	47	nw.	16	12	8	10	5.1	T.
Cape Henry	.....	5	34	.....	.....	.....	54.4	+ 2.3	77	8	62	34	25	47	29	.....	.....	.....	2.02	— 1.6	7	.....	se.	.....	.....	...	9	14	7	....	
Lynchburg	685	83	88	29.42	30.17	+ .03	48.6	+ 0.4	77	15	60	23	24	38	36	42	36	68	2.24	— 0.7	7	3,298	sw.	34	nw.	12	14	7	9	4.7	
Norfolk	57	88	93	30.11	30.18	+ .06	53.1	+ 0.9	76	16	62	32	24	44	29	48	44	77	2.84	— 0.3	8	6,679	sw.	32	sw.	9	17	7	6	3.5	
Richmond	.....	.....	.....	.....	.....	.....	49.1	.....	75	16	59	28	30	39	34	.....	.....	.....	3.07	. .....	8	4,980	s.	.....	.....	...	12	8	10	5.1	
S. Atlantic States.							57.6	+ 1.7												1.04	— 1.4										
Charlotte	773	68	76	29.34	30.18	+ .04	51.4	0.0	73	16	61	28	24	41	28	44	37	64	3.11	+ 0.1	7	5,599	s.	28	s.	2	20	4	6	3.7	
Hatteras	11	17	36	30.17	30.18	+ .07	57.7	+ 1.5	72	*	62	41	24	54	20	54	51	79	0.98	— 4.2	8	11,099	n.	46	n.	23	15	9	6	4.1	
Kittyhawk	9	12	30	.....	.....	.....	56.8	+ 3.1	75	29	62	41	26	52	28	.....	.....	.....	2.50	— 2.0	3	.....	.....	.....	.....	...	19	7	4	....	
Raleigh	375	93	101	29.79	30.19	+ .02	52.8	+ 3.0	76	15	63	27	24	42	32	45	39	67	3.43	+ 1.3	5	4,798	sw.	24	sw.	9	13	10	7	4.4	
Wilmington	78	82	90	30.12	30.20	+ .07	57.0	+ 0.8	76	6	66	32	24	48	32	50	47	78	1.53	— 0.9	4	6,168	s.	29	sw.	9	17	9	4	3.5	
Charleston	48	60	72	30.18	30.23	+ .10	61.8	+ 2.9	80	6	69	42	24	54	23	54	49	70	0.50	— 2.5	7	7,454	ne.	34	s.	1	15	12	3	3.8	
Columbia	.....	5	.....	.....	.....	.....	55.8	+ 0.9	79	4	67	30	19	44	38	.....	.....	.....	1.06	— 1.3	6	.....	sw.	.....	.....	...	16	5	9	....	
Augusta	180	89	103	30.00	30.19	+ .06	56.0	+ 0.6	80	8	68	34	19	45	35	48	44	73	1.02	— 2.0	5	4,308	w.	26	sw.	11	18	4	8	3.4	
Savannah	82	63	86	30.12	30.22	+ .07	61.2	+ 2.0	80	6	70	40	24	52	27	54	50	77	0.71	— 1.6	6	5,789	sw.	26	nw.	11	15	8	7	4.2	
Jacksonville	43	69	84	30.14	30.19	+ .07	65.3	+ 2.1	83	16	74	46	13	57	27	59	57	85	1.56	— 1.0	7	5,114	ne.	30	sw.	2	12	10	8	5.2	
Florida Peninsula.							72.7	+ 1.7												2.84	+ 0.3										
Jupiter	28	13	30	30.11	30.14	+ .04	73.4	+ 1.2	85	1	78	58	3	69	18	67	64	76	6.49	+ 3.1	5	8,137	e.	38	ne.	18	10	16	4	5.2	
Key West	22	42	50	30.11	30.13	+ .07	75.6	+ 1.4	83	*	79	67	4	73	10	70	67	78	1.40	— 0.9	8	9,396	ne.	36	nw.	2	15	10	5	3.9	
Tampa	36	60	67	30.13	30.17	+ .06	69.0	+ 2.4	82	16	77	50	13	61	27	62	60	81	0.63	— 1.4	3	4,568	n.	36	s.	1	16	12	2	3.5	
East Gulf States.							69.6	+ 1.9												2.43	— 1.3										
Atlanta	1,131	92	126	29.00	30.22	+ .05	53.2	+ 1.4	75	14	63	29	30	43	28	48	45	82	2.29	— 1.2	6	7,510	nw.	32	nw.	11	17	6	7	3.5	
Pensacola	56	78	90	30.15	30.21	+ .08	62.5	+ 2.1	78	11	70	41	30	54	22	55	53	77	3.61	— 0.2	6	6,471	ne.	36	sw.	1	14	10	6	3.9	
Mobile	57	88	96	30.14	30.20	+ .06	60.1	+ 1.4	80	16	70	37	30	50	30	55	52	81	3.20	— 0.6	6	4,993	n.	27	n.	16	18	5	7	4.1	
Montgomery	221	100	107	29.96	30.20	+ .04	57.6	+ 0.9	80	7	69	32	30	46	36	50	45	71	1.68	— 1.7	7	4,719	se.	31	w.	1	15	7	8	4.3	
Vicksburg	254	65	73	29.89	30.16	.00	58.1	+ 0.7	80	15	69	29	30	48	35	50	45	70	1.37	— 3.5	9	5,425	se.	30	nw.	1	17	7	6	3.5	
New Orleans	54	112	120	30.13	30.19	+ .07	63.7	+ 2.0	82	8	72	44	30	56	24	57	54	80	3.38	— 0.8	5	6,283	se.	34	n.	16	14	9	7	4.2	
Port Eads	.....	27	.....	.....	.....	.....	69.3	+ 4.5	80	11	75	49	2	64	23	.....	.....	.....	1.47	— 1.4	4	.....	e.	.....	.....	...	7	13	10	....	
West Gulf States.							68.9	+ 1.1												1.36	— 2.6										
Shreveport	249	77	84	29.90	30.17	+ .03	57.4	+ 0.7	83	8	68	29	30	46	35	50	44	68	2.16	— 2.6	5	5,708	se.	28	nw.	1	13	10	7	3.8	
Fort Smith	481	63	72	29.62	30.14	+ .02	51.1	— 0.3	80	20	63	25	30	39	42	44	39	71	1.55	— 2.1	5	5,553	e.	30	s.	4	20	4	6	3.3	
Little Rock	302	71	79	29.85	30.18	+ .04	52.4	— 0.3	80	8	63	24	30	42	35	45	40	70	2.97	— 2.3	6	5,852	s.	27	w.	26	15	7	8	4.6	
Corpus Christi	20	42	50	30.13	30.15	+ .03	65.5	+ 1.8	86	8	71	43	18	60	24	61	58	80	0.11	— 2.9	3	7,354	n.	31	n.	16	13	7	10	4.7	
Galveston	42	85	96	30.11	30.15	+ .03	65.2	+ 1.5	79	8	70	44	17	60	21	60	58	81	1.02	— 3.4	6	8,517	se.	37	n.	16	16	8	6	3.9	
Palestine	510	54	61	29.61	30.17	+ .02	57.8	+ 0.4	84	15	68	30	30	47	38	51	47	74	1.30	— 3.2	8	5,241	n.	22	se.	4	13	11	6	4.4	
San Antonio	704	95	104	29.40	30.14	+ .01	62.8	+ 3.8	86	11	72	38	*	53	34	54	46	61	0.43	— 1.6	2	6,408	n.	36	n.	16	10	9	11	5.3	
Ohio Val. & Tenn.							47.4	+ 0.6												4.77	+ 0.9										
Chattanooga	702	106	112	29.39	30.22	+ .06	51.4	+ 0.2	76	15	62	29	30	41	35	44	39	72	1.18	— 2.8	9	5,280	s.	45	w.	2	11	12	7	4.8	
Knoxville	1,004	80	88	29.12	30.21	+ .03	49.6	+ 1.2	74	15	61	26	30	38	37	42	37	71	1.87	— 1.9	9	5,797	sw.	44	w.	11	15	8	7	4.2	
Memphis	399	140	154	29.74	30.18	+ .04	53.0	+ 0.6	77	22	62	26	30	43	36	45	39	66	5.00	+ 0.3	7	8,392	s.	49	nw.	16	12	8	10	5.1	
Nashville	545	128	134	29.58	30.17	+ .04	50.8	+ 0.6	77	22	61	23	30	40	35	43	37	67	2.83	— 1.0	9	5,985	s.	26	nw.	16	14	9	7	4.8	
Lexington	989	75	122	29.06	30.14	+ .03	46.4	+ 0.3	71	15	56	17	30	37	29	40	34	67	4.83	— 1.2	12	9,552	s.	50	w.	9	10	6	14	6.1	
Louisville	525	114	136	29.56	30.14	+ .01	48.1	0.0	72	21	57	20	30	39	36	42	36	68	5.86	+ 1.8	11	6,790	s.	40	sw.	9	11	6	13	6.0	
Indianapolis	823	154	164	29.22	30.13	+ .02	43.6	+ 1.2	68	30	52	16	30	35	32	39	34	75	6.87	+ 3.0	12	8,885	s.	47	sw.	11	7	6	17	6.7	T.
Cincinnati	628	152	157	29.45	30.14	+ .02	46.0	+ 0.1	68	21	54	19	30	38	32	41	37	73	6.80	+ 3.5	12	5,963	s.	36	w.	9	12	7	11	5.7	T.
Columbus	824	87	100	29.22	30.12	+ .01	42.7	+ 0.3	65	21	51	16	30	34	34	39	36	80	7.54	+ 4.2	14	6,181	sw.	31	w.	11	3	11	16	7.3	T.
Pittsburg	842	116	123	29.20	30.12	+ .01	44.9	+ 0.5	69	4	53	19	30	37	30	41	37	78	5.11	+ 2.6	17	5,566	w.	30	w.	11	4	9	17	7.1	0.2
Parkersburg	638	77	84	29.46	30.16	.00	45.3	+ 1.2	73	26	55	18	30	36	38	40	36	75	4.57	+ 1.4	16	3,805	s.	36	w.	9	4	12	14	6.9	T.
Lower Lake Region.							40.3	— 0.4												5.12	+ 2.0										
Buffalo	768	178	206	29.19	30.04	.00	40.2	+ 0.3	66	5	46	19	30	34	25	37	33	75	5.21	+ 1.7	19	13,701	w.	56	w.	6	1	5	24	8.8	2.6
Oswego	335	76	87	29.65	30.03	— .02	38.7	— 0.2	65	*	44	20	23	33	25	36	32	80	6.56	+ 3.2	21	10,834	nw.	38	nw.	13	2	5	23	8.4	23.5
Rochester	523	81	90	29.45	30.04	— .01	39.4	+ 0.5	67	5	46	18	24	33	27	36	32	78	3.71	+ 0.9	20	6,693	sw.	28	nw.	21	2	8	20	8.0	10.1
Erie	714	92	102	29.28	30.06	+ .01	41.6	— 0.6	66	4	48	22	30	35	27	39	36	81	4.62	+ 0.5	19	10,993	nw.	42	nw.	11	1	6	23	7.4	1.4
Cleveland	762	190	201	29.23	30.07	— .01	41.5	+ 0.3	65	4	48	18	30	35	28	38	34	78	4.13	+ 1.2	30	13,771	s.	68	w.	11	3	4	23	8.4	0.4
Sandusky	629	62	74	29.39	30.09	+ .02	41.9	— 0.3	66	4	49	16	30	34	31	38	33	76	6.21	+ 3.2	15	7,852	sw.	31	w.	11	3	3	24	8.4	T.
Toledo	674	122	127	29.34	30.08	+ .02	40.2	— 1.0	64	4	48	15	30	33	32	36	33	79	5.41	+ 2.6	13	8,234	sw.	33	sw.	26	3	11	16	7.1	0.1
Detroit	730	160	166	29.26	30.07	+ .01	38.8	— 2.3	59	*	45	18	30	32	29	36	32	80	5.13	+ 2.4	14	5,995	w.	35	sw.	5	4	7	19	7.7	0.4
Upper Lake Region.							33.7	— 1.1												2.39	— 0.1										
Alpena	609	61	65	29.34	30.02	.00	34.4	0.0	60	4	40	13	30	29	26	32	30	86	1.50	— 1.3	15	8,030	nw.	36	nw.	12	2	12	16	7.4	5.2
Grand Haven	628	55	64	29.35	30.05	+ .02	38.6	— 0.3	64	4	45	16	29	32	26	35	31	77	2.59	— 0.4	16	8,947	nw.	47	nw.	11	2	10	18	7.8	1.7
Marquette	734	67	96	29.20	30.03	+ .02	30.0	— 3.2	49	3	35	3	28	25	19	28	25	86	1.22	— 1.5	17	7,813	nw.	38	s.	30	2	11	17	7.8	9.2
Port Huron	639	70	108	29.35	30.07	+ .02	38.2	+ 0.1	62	3	45	15	30	32	27	34	31	79	4.90	+ 2.1	14	9,691	s.	38	w.	12	5	9	16	6.7	0.3
Sault Ste. Marie	634	58	65	29.30	30.02	+ .02	30.6	— 0.6	54	3	36	7	23	25	22	29	26	86	4.01	+ 1.5	22	8,403	nw.	45	nw.	11	1	5	24	8.5	29.1
Chicago	834	241	274	29.18	30.00	+ .03	38.7	0.0	66	30	46	7	29	31	35	35	31	75	3.06	+ 0.3	10	14,303	s.	55	sw.	10	9	4	17	6.9	T.
Milwaukee	671	106	149	29.34	30.00	+ .04	36.0	— 0.2	66	30	43	2	29	29	28	32	27	73	1.87	— 0.2	12	8,064	nw.	36	sw.	10	6	4	20	7.5	2.1
Greenbay	617	49	57	29.39	30.08	+ .01	31.8	— 0.8	60	*	39	— 6	30	25	26	28	24	75	1.56	— 0.8	11	6,227	s.	33	nw.	11	6	12	12	6.1	5.2
Duluth	702	95	106	29.29	30.09	+ .06	26.2	— 4.6	56	2	32	— 8	27	20	24	23	20	82	0.78	— 0.8	11	7,290	sw.	36	nw.	23	10	10	10	5.5	3.5
North Dakota.							21.9	— 5.6												0.46	— 0.4										
Moorhead	935	54	60	29.06	30.13	+ .05	23.2	— 2.7	64	2	32	—12	27	14	35	20	18	86	0.28	— 0.6	3	6,280	n.	28	ne.	3	11	12	7	4.9	2.3
Bismarck	1,674	16	29	28.28	30.16	+ .08	23.1	— 5.8	72	19	35	—15	27	11	52	18	12	69	0.25	— 0.4	5	5,784	nw.	36	nw.	14	13	8	9	4.9	2.4
Williston	1,875	15	31	28.06	30.17	+ .09	19.5	— 8.4	69	*	29	—19	27	10	42	17	13	79	0.85	— 0.3	9	5,602	n.	38	nw.	14	19	6	5	4.2	7.8
Upper Miss. Valley.							37.8	— 1.5												2.41	+ 0.2										
Minneapolis	.....	99	.....	.....	.....	.....	29.5	— 2.5	70	3	37	— 6	27	22	34	.....	.....	.....	0.70	0.0	11	.....	n.	.....	.....	...	6	10	14	....	4.8
St. Paul	837	114	124	29.16	30.10	+ .04	29.3	— 3.1	69	3	37	— 8	29	21	35	25	20	73	0.93	— 0.2	12	5,175	nw.	28	nw.	10	5	11	14	6.3	6.0
La Crosse	.....	70	78	.....	.....	.....	32.7	— 3.3	72	20	41	— 4	29	24	34	.....	.....	.....	0.75	— 0.7	6	5,579	n.	36	nw.	11	8	9	13	6.2	5.3
Davenport	599	71	79	29.42	30.09	.00	37.8	— 1.5	72	20	47	2	29	29	31	33	26	69	1.68	— 0.4	11	5,705	nw.	27	nw.	10	9	6	15	6.2	0.3
Des Moines	867	84	88	29.17	30.14	+ .04	36.4	— 1.6	76	20	47	— 1	29	25	38	31	23	64	0.34	— 1.4	7	6,102	sw.	32	sw.	20	14	5	11	4.5	1.3
Dubuque	698	49	56	29.31	30.10	+ .02	35.1	— 1.9	70	20	44	0	29	27	36	31	27	76	1.23	— 0.9	7	5,521	nw.	30	nw.	11	9	8	13	5.5	T.
Keokuk	614	64	78	29.43	30.11	+ .02	40.8	— 0.5	75	20	50	5	29	31	33	35	30	71	2.17	0.0	8	6,231	nw.	42	n.	1	11	7	12	5.1	T.

TABLE I.—*Climatological data for Weather Bureau Stations, November, 1897*—Continued.

Stations.	Elevation of instruments: Barometer above sea level, feet.	Thermometers above ground.	Anemometers above ground.	Pressure, in inches: Mean actual, 8 a. m. and 8 p. m. + 2.	Mean reduced.	Departure from normal.	Temperature of the air, in degrees Fahrenheit: Mean max. and min. + 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches: Total.	Departure from normal.	Days with .01, or more.	Wind: Total movement, miles.	Prevailing direction.	Maximum velocity: Miles per hour.	Direction.	Date.	Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
Up. Miss. Val.—Con																															
Cairo	359	87	93	29.75	30.14	+ .03	49.5	+ 1.1	75	21	58	21	30	40	35	44	40	77	5.50	+ 1.3	10	7,403	s.	40	w.	26	8	9	13	6.0	
Springfield, Ill.	644	82	92	29.40	30.12	+ .01	41.2	— 2.0	70	20	49	12	29	33	28	36	31	72	4.94	+ 2.0	11	7,940	s.	30	n.	1	8	10	12	5.7	T.
Hannibal	534	75	107	.....	.....	.....	41.8	.....	77	20	52	8	29	31	37	....	....	...	2.07	— 0.2	9	7,583	sw.	34	sw.	10	11	8	11	5.5	
St. Louis	567	110	210	29.52	30.14	+ .02	46.1	— 0.1	74	30	55	16	29	37	33	40	34	69	6.21	+ 3.1	10	7,695	s.	37	w.	8	10	6	14	5.4	T.
Missouri Valley.							37.4	— 1.5											0.84	— 0.6											
Columbia	.....	4	84	.....	.....	.....	43.5	— 1.3	80	20	56	8	29	31	44	....	....	....	2.55	— 0.3	8	6,876	s.	29	sw.	30	9	7	14	6.0	
Kansas City	963	78	95	29.09	30.15	+ .03	43.9	+ 0.6	79	20	54	7	29	34	32	37	30	66	1.25	— 0.9	7	7,068	nw.	30	nw.	15	13	7	10	4.8	T.
Springfield, Mo.	1,324	164	103	28.70	30.13	+ .02	45.8	— 0.4	77	20	56	13	29	36	33	39	33	69	1.77	— 1.8	9	9,091	se.	35	nw.	8	14	7	9	4.5	
Topeka	.....	81	.....	.....	.....	.....	43.8	— 0.4	82	20	56	5	29	31	39	....	....	....	0.56	— 0.7	5	.....	s.	....	.....	...	12	13	5	....	
Lincoln	1,199	74	84	28.80	30.13	.....	37.2	— 0.9	73	3	48	0	29	27	37	31	26	70	0.29	— 0.4	4	7,967	n.	40	ne.	15	11	11	8	4.9	0.2
Omaha	1,103	92	97	28.90	30.12	.00	36.5	— 2.5	71	20	46	— 2	29	27	34	31	24	66	0.14	— 0.9	6	5,810	n.	31	nw.	15	12	11	7	5.0	0.7
Sioux City	1,139	96	164	.....	.....	.....	32.7	— 1.6	73	20	44	— 4	29	22	44	...	...	....	0.49	— 0.2	4	9,087	n.	45	nw.	10	13	5	12	5.4	1.6
Pierre	1,460	50	61	28.49	30.12	+ .01	29.8	— 4.4	75	19	41	—12	29	19	47	34	20	76	0.41	0.0	6	5,439	se.	39	nw.	10	10	13	7	5.0	3.3
Huron	1,306	56	67	28.67	30.15	+ .04	27.8	— 3.6	72	19	40	—19	29	16	44	22	18	75	0.67	+ 0.1	5	8,293	nw.	48	nw.	10	10	12	8	5.5	6.7
Yankton	1,234	52	58	.....	.....	.....	32.9	— 0.7	78	3	44	— 8	29	22	48	...	....	....	0.24	— 0.4	6	6,079	sw.	34	sw.	3	13	4	13	5.2	4.2
Northern Slope.							30.1	— 2.7											1.25	+ 0.7											
Havre	2,494	15	33	27.37	30.14	+ .05	18.2	—12.6	71	1	27	—21	28	10	50	16	13	85	2.08	+ 1.4	12	6,741	sw.	40	sw.	8	5	9	16	6.9	18.5
Miles City	2,372	41	49	27.52	30.13	.00	25.2	— 6.1	76	19	33	—26	28	17	41	22	19	84	1.18	+ 0.8	15	4,354	s.	30	w.	10	3	17	10	6.4	8.3
Helena	4,108	88	93	25.82	30.18	+ .04	28.2	— 4.4	69	19	37	—10	28	20	47	24	17	70	2.22	+ 1.5	14	4,417	sw.	38	sw.	19	5	6	19	7.1	23.3
Rapid City	3,251	46	50	26.62	30.12	— .02	30.6	— 2.5	76	19	41	— 8	28	20	54	25	19	76	1.16	+ 0.8	13	4,880	nw.	36	sw.	20	7	10	13	6.4	9.9
Cheyenne	6,105	58	60	23.97	30.11	— .04	37.4	+ 2.0	72	19	50	5	26	25	39	29	15	50	0.68	+ 0.4	7	8,586	w.	54	w.	10	10	14	6	4.8	6.8
Lander	5,372	28	36	24.62	30.13	— .07	34.5	+ 7.5	70	19	47	5	28	22	45	28	20	66	0.44	— 0.4	4	3,146	sw.	30	sw.	13	7	13	10	5.8	4.4
North Platte	2,826	43	52	27.12	30.17	+ .02	36.4	— 0.9	79	20	49	1	29	24	46	29	24	73	0.85	+ 0.5	4	5,784	w.	33	nw.	10	13	14	3	4.2	4.5
Middle Slope.							43.6	+ 0.6											0.23	— 0.6											
Denver	5,290	79	151	24.72	30.14	— .04	40.8	+ 0.8	77	19	54	7	29	28	40	32	21	54	0.24	— 0.4	4	5,395	s.	51	w.	10	4	18	8	5.3	3.3
Pueblo	4,713	74	81	25.28	30.10	— .03	42.8	+ 2.1	80	19	59	9	29	26	53	33	20	51	0.10	— 0.2	1	4,882	w.	36	w.	20	13	11	6	4.5	0.3
Concordia	1,398	42	47	28.59	30.13	— .01	40.3	— 1.4	79	20	52	3	29	29	43	33	29	74	0.39	— 0.5	3	4,969	s.	27	n.	15	14	7	9	4.6	0.2
Dodge City	2,504	44	52	27.45	30.13	+ .02	43.0	+ 0.7	84	20	58	7	29	28	48	32	25	65	0.06	— 0.4	2	7,441	s.	37	ne.	15	16	11	3	3.4	T.
Wichita	1,351	78	85	28.65	30.12	— .01	45.8	+ 2.3	83	20	58	7	29	33	39	37	29	62	0.10	— 0.8	3	7,499	s.	31	n.	28	16	9	5	3.8	
Oklahoma	1,218	54	53	28.82	30.15	+ .03	48.6	— 0.7	78	7	61	11	29	36	36	41	34	66	0.58	— 1.3	1	9,214	s.	36	n.	28	22	4	4	2.5	
Southern Slope.							51.0	+ 1.8											0.04	— 0.8											
Abilene	1,749	47	54	28.32	30.18	+ .04	55.2	+ 1.5	84	3	68	20	29	42	40	44	34	52	0.01	— 1.4	1	7,832	sw.	30	w.	4	18	10	2	2.5	
Amarillo	3,691	54	61	26.31	30.14	+ .01	46.8	+ 2.1	82	3	62	12	29	32	47	36	24	50	0.08	— 0.2	1	11,823	s.	46	sw.	25	20	8	2	2.8	
Southern Plateau.							54.9	+ 2.2											0.02	— 0.5											
El Paso	3,767	10	110	26.27	30.12	+ .01	55.2	+ 3.1	83	21	71	29	30	40	46	41	25	39	T.	— 0.5	0	6,845	nw.	44	w.	25	22	7	1	2.3	
Santa Fe	6,998	47	50	23.32	30.16	+ .03	41.4	+ 3.3	63	22	53	17	16	30	32	31	19	47	0.08	— 0.7	2	3,864	se.	30	ne.	10	22	5	3	3.0	
Phœnix	1,076	47	57	28.85	29.99	.....	60.4	+ 2.8	88	19	77	31	9	44	40	45	30	37	0.00	— 0.4	0	2,324	e.	19	w.	3	22	5	3	2.4	
Yuma	139	16	50	29.85	30.00	— .02	62.5	— 0.2	88	2	77	38	28	48	40	48	33	38	0.00	— 0.3	0	3,769	n.	....	.....	...	24	4	2	1.8	
Middle Plateau.							41.7	+ 2.1											0.81	— 0.3											
Carson City	4,720	82	92	25.32	30.14	.....	42.7	+ 1.0	72	1	56	15	26	29	44	34	23	51	0.85	— 0.6	3	5,476	sw.	59	sw.	20	12	14	4	4.5	1.6
Winnemucca	4,340	59	70	25.70	30.13	— .07	39.2	+ 2.0	70	1	52	5	15	26	52	34	25	54	0.38	— 0.2	5	.....	w.	....	.....	...	7	13	10	....	2.0
Salt Lake City	4,344	83	90	25.71	30.18	— .05	43.2	+ 3.2	68	2	53	24	16	34	31	36	29	63	1.19	— 0.2	9	3,557	se.	33	w.	7	7	10	13	6.0	3.4
Northern Plateau.							38.8	+ 0.9											3.68	+ 2.4											
Baker City	3,470	49	55	26.45	30.12	— .06	36.4	— 0.7	65	1	44	16	28	29	30	32	27	72	1.80	+ 0.9	17	4,163	nw.	36	sw.	19	6	4	20	7.1	6.4
Idaho Falls	4,742	10	56	25.26	30.15	— .06	37.0	+ 6.7	64	19	46	16	8	28	38	33	30	84	1.90	+ 1.0	12	9,048	s.	41	s.	20	6	6	18	7.0	8.4
Spokane	1,943	99	107	27.97	30.08	— .06	35.8	— 1.6	65	18	42	7	28	30	26	34	30	79	5.85	+ 4.2	19	4,358	sw.	37	sw.	18	2	2	26	8.8	24.2
Walla Walla	1,018	65	73	28.96	30.08	— .11	41.8	— 0.7	75	18	48	11	28	36	28	39	35	80	5.15	+ 3.7	20	4,704	s.	36	s.	18	2	14	14	6.7	9.8
N. Pac. Coast Reg.							44.8	— 1.4											11.46	+ 4.7											
Fort Canby	179	10	34	29.81	30.01	— .04	45.8	— 1.9	54	18	49	34	19	42	13	44	42	90	14.99	+ 6.5	30	11,756	e.	88	se.	18	1	5	24	8.8	
Port Angeles	29	47	62	.....	.....	.....	41.0	— 1.4	57	12	46	24	28	36	19	....	....	....	6.03	+ 1.6	18	4,018	sw.	30	w.	18	3	9	18	7.5	
Pysht c	.....	5	....	.....	.....	.....	41.1	.....	57	18	46	30	*	36	19	....	....	....	14.37	+ 6.0	20	.....	e.	....	.....	...	5	2	20	....	2.0
Seattle	119	100	108	29.88	30.01	.....	43.6	.....	61	18	48	29	28	39	21	42	39	86	8.89	.....	22	4,950	se.	29	se.	18	0	6	24	8.8	0.5
Tacoma	213	....	....	.....	.....	.....	42.9	....	64	18	48	28	30	38	23	...	....	....	12.31	.....	24	5,082	sw.	29	ne.	22	1	4	25	9.0	2.0
Tatoosh Island †	86	7	21	29.86	29.96	— .04	43.8	— 2.6	54	*	47	32	28	40	18	42	38	79	17.77	+ 5.6	25	10,683	e.	48	s.	17	2	6	22	7.9	2.5
Astoria	.....	39	60	.....	.....	.....	46.4	— 1.1	62	18	51	34	30	42	18	...	....	....	15.36	+ 5.8	27	.....	w.	....	.....	...	1	2	27	....	
Portland, Oreg	153	203	213	29.88	30.05	— .05	44.7	— 1.8	66	18	50	29	20	40	24	43	41	87	11.65	+ 5.9	24	7,130	s.	52	s.	18	0	6	24	8.5	3.0
Roseburg	521	56	67	29.52	30.09	— .05	46.0	— 0.7	70	18	53	29	15	39	32	43	41	83	6.33	+ 2.6	16	2,133	s.	20	s.	18	3	17	10	6.7	1.4
Mid. Pac. C'st Reg.							51.1	— 2.4											2.12	— 0.9											
Eureka	64	60	69	30.10	30.16	+ .06	49.7	— 0.4	70	18	56	33	15	43	25	47	44	83	5.44	+ 1.4	18	3,408	se.	29	se.	19	4	13	13	6.7	
Redbluff	334	54	58	29.78	30.14	+ .03	49.7	— 3.7	76	10	59	32	26	40	30	44	38	70	1.49	— 1.6	7	2,938	n.	22	n.	3	12	7	11	5.2	
Sacramento	71	106	117	30.06	30.14	+ .04	50.8	— 2.6	74	10	61	31	27	40	30	46	40	69	0.61	— 1.5	4	4,412	ne.	22	nw.	6	12	11	7	4.9	
San Francisco	153	161	167	30.00	30.16	+ .06	53.1	— 2.9	68	10	58	44	26	48	19	48	45	78	1.05	— 1.6	8	5,306	w.	29	w.	20	10	12	8	5.6	
Point Reyes Light	.....	12	....	.....	.....	.....	52.0	— 2.6	70	11	58	41	24	46	23	....	....	....	1.99	— 1.1	5	.....	nw.	....	.....	...	10	9	11	....	
S. Pac. Coast Reg.							57.9	— 0.3											0.08	— 1.1											
Fresno	332	67	70	29.74	30.10	+ .02	52.0	— 3.4	78	19	64	28	27	40	34	45	39	66	0.22	— 1.0	4	2,979	nw.	18	nw.	2	16	11	3	3.7	
Los Angeles	330	74	82	29.70	30.05	+ .01	61.6	+ 1.6	92	18	74	37	27	49	34	50	42	60	0.01	— 1.4	1	2,650	w.	16	w.	6	19	10	1	1.9	
San Diego	87	59	70	29.95	30.05	.00	60.2	+ 1.0	83	18	68	45	26	52	28	51	44	64	0.02	— 0.8	1	3,683	nw.	18	nw.	9	28	0	2	1.7	
San Luis Obispo	201	10	46	29.90	30.12	.....	56.6	.....	88	18	70	29	27	43	46	47	40	63	0.07	.....	2	3,513	n.	22	n.	8	20	8	2	3.4	

NOTE.—The data at stations having no departures are not used in computing the district averages. Letters of the alphabet denote number of days missing from the record. * Two or more dates. † Received too late to be considered in departures, etc.

TABLE II.—*Meteorological record of voluntary and other cooperating observers, November, 1897.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Alabama.	°	°	°	*Ins.*	*Ins.*
Alco†	81	32	59.4	4.59	
Ashville †	81	22	52.6	0.77	
Bermuda†	83	32	59.9	0.88	
Birmingham†	80	26	56.7	0.84	
Bridgeport†	.....	.....	.....	1.60	
Citronelle†	77	37	61.2	2.78	
Clanton †	75	29	54.0	1.78	
Daphne†	83	35	59.2	2.62	
Decatur†	78	22	51.1	1.54	
Demopolis	.....	.....	.....	2.80	
Elba†	78	32	57.4	3.31	
Eufaula *a*†	83	33	58.0	2.04	
Evergreen	74	34	55.2	2.95	
Florence *a*†	.....	.....	.....	3.60	
Florence *b*†	76	26	51.4	1.82	
Gadsden	77	24	53.0	0.94	
Greensboro†	79	29	55.2	1.73	
Hamilton	79	24	50.8	1.30	
Healing Springs†	83	28	55.4	2.56	
Highland Home †	78	33	59.4	0.50	T.
Jasper	80	21	50.2	0.88	
Livingston	78	30	52.6	2.58	
Lock No. 4	74	28	50.3	1.96	
Madison Station †	77	22	48.8	1.65	
Maple Grove	.....	.....	.....	0.75	
Marion †	78	28	57.1	0.84	
Mount Willing †	80	28	58.0	2.66	
Newbern†	78	29	56.2	1.49	
Newburg	.....	.....	.....	1.49	
Newton†	80	32	57.9	1.26	
Oneonta	76	20	51.8	0.82	
Opelika †	80	32	57.0	3.29	
Oxanna †	76	25	50.3	1.87	
Pineapple	80	27	56.1	1.78	
Pushmataha †	80	31	56.6	0.92	
Riverton †	79	26	49.6	6.58	
Rockmills†	79	32	56.4	2.04	
Scottsboro †	79	27	51.9	4.08	
Selma †	80	30	56.2	1.56	
Talladega *1	72	26	51.2	1.17	
Tallassee	.....	.....	.....	1.97	
Thomasville	78	30	56.4	2.43	
Tuscaloosa†	76	32	53.8	1.72	
Tuscumbia	78	26	51.7	2.72	
Union†	80	26	56.6	1.15	
Union Springs†	77	32	56.2	3.00	
Uniontown†	78	31	57.8	0.85	
Valleyhead	77	27	50.6	0.63	
Warrior	.....	.....	.....	1.07	
Wetumpka	79	30	55.2	2.47	
Wilsonville †	.....	.....	.....	2.23	
Arizona.					
Antelope Valley	.....	.....	.....	0.00	
Arizona Canal Co. Dam	88	34[d]	65.8[b]	0.00	
Benson *3	81	33	59.7	0.00	
Bisbee†	76	35	56.5	0.00	
Buckeye†	87	25	58.2	0.00	
Calabasas	80	26	55.4	0.00	
Camp Creek	79	31	59.0	0.00	
Casa Grande *3	70	38	53.4	0.00	
Cedar Springs	79	26	54.3	T.	
Congress	83	39	62.4	T.	
Dragoon	.....	.....	.....	0.00	
Dragoon Summit *3	88	45	59.4	0.00	
Dudleyville	82	26	56.5	0.00	
Empire Ranch	85	32	55.2	0.00	
Farleys Camp†	83	32	62.2	0.00	
Flagstaff †	74	10	44.4	T.	
Fort Apache	74	17	47.1	0.00	
Fort Defiance	64	10	35.3	0.46	2.0
Fort Grant †	80	33	56.3	0.00	
Fort Huachuca †	80	31	56.2	0.00	
Fort Mojave	92	32	60.4	0.00	
Gilabend *a* *3	86	40	51.4	0.00	
Gisela	78	17	51.2	0.00	
Holbrook †	76	10	43.1	T.	
Jerome	72	31	53.2	T.	
Lochiel *1	74	30	51.7	0.00	
Maricopa *3	101	34	66.1	0.00	
Mesa †	84	28	58.1	T.	
Mount Huachuca	78	31	54.6	0.00	
Music Mountain	85	21	52.4	0.03	
Natural Bridge	.....	.....	.....	0.00	
Oracle†	75	30	57.0	0.50	
Oro Blanco	80	29	56.8	0.00	
Pantano *3	72	38	56.1	0.00	
Parker	92	26	58.4	T.	
Payson	.....	.....	.....	0.00	
Peoria †	83	33	58.4	0.00	
Phœnix	84	25	56.8	0.00	
Pinal Ranch	.....	.....	.....	0.00	
St. Helena Ranch	.....	.....	.....	T.	T.
San Carlos †	85	23	53.9	0.00	
San Simon *3	88	27	55.9	0.00	
Signal †	82	31	56.0	T.	
Snowflake	70	9	41.4	T.	
Arizona—Cont'd.					
Strawberry	71	11	42.8	T.	T.
Sulphur Spring Valley	.....	.....	.....	0.00	
Texas Hill *3	85	39	54.6	0.00	
Tombstone	79	34	57.3	0.00	
Tucson *c* †	89	28	60.4	0.00	
Walnut Grove	.....	.....	.....	0.00	
Whipple Barracks†	78	11	44.8	T.	
White Hills	81	30	56.5	T.	
Willcox *3	84	38	61.9	0.04	
Williams	68	14	44.4	T.	T.
Arkansas.					
Amity	88	20	52.6	1.88	
Arkansas City†	.....	.....	.....	3.35	
Beebranch	79	17	50.8	2.58	
Blanchard Springs†	80	23	54.4	2.83	
Camden *a* †	.....	.....	.....	3.58	
Camden *b* †	82	25	53.2	2.85	
Canton *1	78	18	48.7	.....	
Conway	83	20	52.9	2.37	
Dallas	79	19	52.0	1.81	
Dardanelle	.....	.....	.....	0.86	
Elon †	80	25	54.6	2.35	
Fayetteville †	76	17	48.8	1.41	
Forrest	78	25	53.0	5.80	
Fulton †	.....	.....	.....	2.29	
Hardy	78	18	49.0	2.27	
Helena *a* †	.....	.....	.....	5.88	
Helena *b*	80	26	55.2	4.42	
Hot Springs *a*	80	24	53.6	.....	
Hot Springs (near)	.....	.....	.....	3.26	
Jonesboro	77	21	49.9	2.70	
Keesees Ferry †	82	17	50.3	2.60	
Lacrosse †	74	19	46.6	2.62	
Lonoke *1	79	25	50.4	4.12	
Luna Landing *6	78	28	56.5	1.99	
Lutherville *1	88	24	53.1	.....	
Magnolia	83	26	56.3	2.29	
Malvern †	82	22	49.8	3.79	
Marianna *1	78	27	53.0	.....	
Marvell	78	26	54.8	4.46	
Monticello	80[a]	23[c]	55.1[g]	3.01	
Moore	.....	.....	.....	1.65	T.
Mossville	73	19	47.0	4.34	
Mount Nebo †	75	24	48.8	1.71	
New Gascony *1	76	22	52.2	3.85	
Newport *a* †	.....	.....	.....	3.86	
Newport *b* †	80	18	50.2	2.88	
Newport *c* †	80[a]	20[c]	49.7[g]	3.06	
Oregon *1	76	18	46.5	.....	
Ozark †	80	25	53.6	2.38	T.
Picayune †	80	25	54.6	1.71	
Pinebluff †	82	25	54.2	2.96	
Pocahontas †	76	20[c]	46.9[c]	3.68	
Powell *† 1	86	19	47.9	2.63	
Rison	80	27	51.6	3.39	
Russellville	78	20	48.0	2.74	
Silver Springs †	75	15	47.6	1.54	
Spielerville	79	23	50.8	1.62	
Stamps	84	28	54.2	2.48	
Stuttgart †	78	22	52.8	3.84	
Texarkana †	.....	.....	.....	1.90	
Warren †	80	23	53.5	3.30	
Washington *† 1	81	28	54.8	1.98	
Wigga *1	77	20	53.3	2.48	
Winslow	71	20	46.8	3.31	
Witts Springs †	78	18	50.0	2.59	
California.					
Agnew	74	34	53.9	1.40	
Arlington Heights	89	35	59.2	0.06	
Athlone *3	77	30	56.6	0.35	
Azusa	.....	.....	.....	0.30	
Ballast Point L. H	.....	.....	.....	0.10	
Bear Valley	.....	.....	.....	5.56	10.0
Berkeley	65	40	51.0	1.58	
Bishop †	76	17	46.4	T.	
Boca *3	66	1	33.4	2.80	5.0
Bodie †	57	— 2	31.6	0.54	7.0
Bowmans Dam *† 1	68	24	40.6	5.35	7.0
Caliente *3	72	35	52.8	0.00	
Calloway Canal *† 3	83	31	56.8	0.05	
Campbell	68	28	49.6	0.54	
Cape Mendocino L. H	.....	.....	.....	4.20	
Castle Pinckney *1	84	44	70.0	T.	
Cedarville †	70	11	39.4	2.10	7.0
Centerville *1	73	38	54.1	0.92	
Chico *3	78	34	55.7	1.58	
Cisco *3	57	15	34.3	.....	.....
Claremont †	84	33	56.9	0.47	
Corning *3	71	30	47.8	0.65	
Craftonville	80	31	54.0	.....	
Crescent City †	64	33	48.2	10.45	
Crescent City L. H	.....	.....	.....	9.25	
Daunt	.....	.....	.....	0.73	
Delano *3	77	30	51.5	0.14	
Delta *3	76	28	45.9	3.55	
Descanso *3	77	20	51.5	0.40	
California—Cont'd.					
Drytown	72	30	49.4	1.60	
Dunnigan *3	68	32	51.3	0.49	
Durham *1	70	33	50.0	1.93	
East Brother L. H	.....	.....	.....	1.40	
Edmanton *1	68	20	39.6	8.17	10.0
Elsinore	90	30	60.3	T.	
Escondido	84	21	53.2	0.05	
Fallbrook *1	87	39	56.4	0.17	
Folsom City *b*	74	34	51.1	1.02	
Fordyce Dam	.....	.....	.....	5.48	16.0
Fort Bragg †	.....	.....	.....	2.92	
Fort Ross	70	37	51.8	3.45	
Georgetown	73	30	48.5	4.09	
Glendora	.....	.....	.....	0.92	
Goshen *3	77	29	49.0	0.39	
Grand Island *2	74	33	52.2	0.63	
Grass Valley	.....	.....	.....	4.86	
Greenville †	73	14	40.8	6.39	4.0
Guinda	.....	.....	.....	0.90	
Healdsburg *1	68	30	48.4	2.23	
Hollister	81	27	50.6	0.46	
Humboldt L. H	.....	.....	.....	4.88	
Hydesville	70	30	48.6	4.13	
Indio *3	87	30	61.5	0.00	
Iowa Hill *1	73	30	45.6	3.49	
Jackson	74	26	47.7	2.25	
Jolon	.....	.....	.....	0.12	
Keeler *3	82	32	53.9	T.	
Keene *3	72	29	47.8	0.00	
Kennedy Gold Mine	73	31	49.2	2.50	
Kernville	.....	.....	.....	0.00	
King City *3	78	26	51.1	0.18	
Kingsburg *3	75	30	48.1	0.45	
Kono Tayee	66	35	49.5	1.64	
Laporte *† 1	63	16	37.7	9.34	6.0
Lemoore *a* *3	70	24	48.7	0.18	
Lick Observatory	70	29	45.3	1.51	
Lime Kiln	87	33	56.1	.....	
Lime Point L. H	.....	.....	.....	1.18	
Lodi	69	31	50.2	0.66	
Los Alamos	.....	.....	.....	0.00	
Los Gatos *b*	66	36	49.8	0.88	
Lytton Springs	70	32	49.9	2.15	
Malakoff Mine *1	73	30	46.8	6.12	1.5
Mammoth Tank *3	87	42	63.7	0.00	
Manzana	73	20	45.5	T.	
Mare Island L. H	.....	.....	.....	1.70	
Merced *3	78	32	50.2	0.17	
Mills College	.....	.....	.....	1.48	
Milton (near) *1	77	39	55.6	1.07	
Modesto *3	75	32	55.1	0.11	
Mokelumne Hill *3	.....	37	47.0	2.61	
Monterey *3	66	37	53.3	0.40	
Mount Frazier	.....	.....	.....	T.	
Napa *b*	73	31	49.3	1.40	
Needles	82	35	59.6	0.06	
Nevada City	71	27	45.0	4.38	
Newcastle *a*	68	40	51.1	.....	
Newhall *3	89	24	52.9	0.00	
North San Juan *1	74	28	45.9	5.80	
Oakland *a*	68	37	50.7	1.18	
Ogilby *3	85	50	66.5	0.00	
Oleta *1	71	31	45.8	2.20	
Orangevale †	70	30	48.6	0.36	
Orland *3	84	32	53.5	0.73	
Oroville *b*	72	36	53.0	2.65	
Palermo †	71	31	48.8	2.07	
Paso Robles *b*	74	26	51.6	0.05	
Peachland *1	68	31	48.9	2.34	
Piedras Blancas L. H	.....	.....	.....	0.30	
Pigeon Point	.....	.....	.....	0.65	
Pilot Creek	.....	.....	.....	3.98	3.0
Pine Crest	86	46	63.0	0.01	
Placerville	70	25	45.5	2.68	
Point Ano Nuevo L. H	.....	.....	.....	1.26	
Point Arena L. H	.....	.....	.....	3.14	
Point Bonita L. H	.....	.....	.....	1.69	
Point Conception L. H	.....	.....	.....	0.00	
Point Fermin L. H	.....	.....	.....	0.00	
Point George L. H	.....	.....	.....	4.79	
Point Hueneme L. H	.....	.....	.....	0.00	
Point Lobos	65	43	51.4	1.20	
Point Loma L. H	.....	.....	.....	0.00	
Point Montara L. H	.....	.....	.....	2.08	
Point Pinos L. H	.....	.....	.....	0.38	
Point Reyes L. H	.....	.....	.....	1.99	
Point Sur L. H	.....	.....	.....	0.57	
Pomona (near)	88	32	57.6	0.51	
Poway *3	90	28	47.6	0.08	
Quincy †	66	19	41.1	6.13	2.0
Ravenna *3	90	33	57.2	0.00	
Redding *b* †	76	30	49.0	1.69	
Represa	66	34	53.0	1.11	
Rio Vista	70	30	51.0	0.30	
Roe Island L. H	.....	.....	.....	0.30	
Rosewood	77	22	45.1	1.16	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Sacramento *a*	68	32	49.6	0.78	
Salinas *[8]	70	32	50.6	0.43	
Salton *[8]	85	42	68.7	0.00	
San Bernardino †	86	29	56.6	0.21	
San Jacinto	85	26	55.1	0.34	
San Leandro *[1]	82	39	55.1	1.21	
San Luis L. H				0.04	
San Mateo *[6]	65	40	53.9	1.00	
San Miguel *[8]	75	22	51.7	0.03	
San Miguel Island	77	39	56.2	0.00	
Santa Ana *[5]	88	38	65.5	0.00	
Santa Barbara *a*	85	41	58.6	0.00	
Santa Barbara L. H				0.00	
Santa Clara *a*				0.56	
Santa Cruz *b* †	78	29	51.7	0.54	
Santa Cruz L. H				0.41	
Santa Maria	84	31	56.0	0.03	
Santa Monica *[8]	75	34	61.3		
Santa Paula	83	33	56.5	0.00	
Santa Rosa *[3]	67	34	51.8	2.18	
Saticoy				0.00	
Shasta				2.20	
Sierra Madre	83	42	60.5	0.32	
Sneddens Ranch *[1]	70	0	33.6	0.00	
S. E. Farallone L. H				1.05	
Stanford University	67	32	50.6	0.48	
Stockton *a*	68	30	49.3	0.39	
Summerdale †	64	18	43.0	2.80	4.0
Susanville †	65	20	43.0	3.13	1.0
Sutter Creek *[5]	68	26	44.5	1.92	
Tehama *[6]	76	34	50.3	0.56	
Templeton *[3]	75	25	47.3	0.00	
Trinidad L. H				6.54	
Truckee *[3]	60	10	39.4	3.20	4.0
Tulare *b*				0.35	
Tulare *c*	86	26	51.6	0.26	
Ukiah †	72	27	48.2	3.02	
Upper Mattole *[1]	70	36	50.4	5.93	
Vacaville *a* *[1]	73	33	51.7	1.03	
Ventura †	86	33	54.4	0.07	
Volcano Springs *[3]	95	39	64.1	0.00	
Walnut Creek	69	31	52.2	1.06	
West Palmdale *[1]	72	23	45.6	0.00	
Westpoint				3.61	
Wheatland †	66	28	48.2	1.64	
Williams *[6]	70	35	51.8	0.52	
Wilmington *[5]	93	39	63.3	0.00	
Wire Bridge *[5]	77	29	49.8	2.47	
Yerba Buena L. H				1.06	
Yreka †	73	20	40.8	2.94	T.
Yuba City *[6]	67	37	49.8	1.30	
Colorado.					
Antlers †	64	17	37.8	1.16	
Arkins				0.82	8.2
Boulder	73	10	41.8	0.47	5.5
Boxelder				0.83	8.0
Breckenridge †	60	— 6	26.2	0.60	6.0
Canyon †	79	10	44.8	0.20	0.5
Castlerock	80[1]	5[f]	38.4[h]		
Cheyenne Wells	79	3	39.8	0.10	1.0
Collbran				1.16	
Colorado Springs †	73	11	40.2	0.19	3.4
Cope	76	8	37.2	0.18	2.0
Crook	76	6	40.5	0.15	1.5
Delta	66	13	38.3	0.40	T.
Dumont †				0.20	2.0
Durango	64	13	39.8	0.09	1.0
Fleming				0.91	5.5
Fort Collins †	76	— 3	36.1	0.67	
Fort Morgan	70	— 5	33.4	0.36	2.0
Fox				0.20	2.0
Garnett	61	— 2	30.9	0.00	
Gleneyrie †	69	10	39.8	0.41	1.5
Grand Junction †	64	22	41.2	0.33	
Greeley †	75	— 3	35.6	0.40	4.0
Gulch †	58	8	34.7	1.22	11.0
Hoehne	74	12	41.8	0.01	
Holly				T.	T.
Hugo				0.00	
Hugo (near)	75	6	36.3	T.	T.
Husted †	75	5	41.8	0.33	4.0
Lake Moraine †	58	0	32.8	1.00	10.0
Lamar †	80	8	41.7	0.04	0.5
Laporte				1.10	11.0
Las Animas †	73	11	41.5	0.00	
Leadville (near) *† [1]	60	6	30.2	0.62	6.5
Leroy †	70	4	37.1	0.40	4.0
Longs Peak	72	— 4	33.8	1.07	11.5
Loveland				0.59	5.0
Meeker †	65	5	35.1	1.02	10.3
Minneapolis †	84	7	43.2	T.	
Moraine †	62	1	37.7	1.25	12.5
Pagoda †	67	2	34.6	1.10	11.0
Paonia †				T.	T.
Parachute †	64	8	35.8	0.20	0.5
Pinkhamton				1.10	11.0

Stations	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Colorado—Cont'd.	°	°	°	*Ins.*	*Ins.*
Rangely †	62	12	36.4	0.26	2.5
Redcliff				1.44	14.4
Rico	57	— 2	30.8	1.60	16.0
Rockyford	80	10	41.7	0.19	0.5
Ruby				3.50	35.0
Saguache †	59	8	33.9	0.10	1.0
Salida	75	10	42.2	0.00	
San Luis †	67	2	36.0	0.00	
Santa Clara *[1]	65	11	38.1	0.50	5.0
Seibert †				0.20	2.0
Smoky Hill Mine	80	7	41.2	0.80	8.0
Springfield				T.	T.
Stamford *[1]	70	10	33.0	0.40	4.0
Steamboat Springs	60	— 7	30.4	1.50	15.0
Strickler Tunnel				0.80	8.0
Surface Creek †	70	11	39.2	0.45	5.0
T. S. Ranch †	67	19	40.2	0.86	
Twin Lakes				0.73	8.0
Vilas				0.00	
Wray †	76	1	38.0	0.07	1.0
Yuma				0.10	1.0
Connecticut.					
Bridgeport	64	15	42.5	6.40	2.6
Canton †	65	5	38.4	6.31	5.0
Colchester	65	9	41.0	6.18	6.2
Falls Village				5.94	8.2
Hartford				6.45	4.0
Middletown	68	12	41.6	6.60	6.0
New London †	63	11	41.8	7.85	13.8
Norwalk	63	10	41.1	6.06	3.5
Southington *[1]	62	11	39.4	5.50	6.0
Storrs	64	5	37.8	7.14	6.5
Voluntown †	64	2	41.0	8.17	7.0
Waterbury	67	15	41.9	6.00	3.0
West Cornwall †	60	9	37.6	5.54	8.8
Windsor	62	10	38.4	6.90	6.4
Delaware.					
Millsboro	72	21	48.7	3.00	T.
Newark	69	23	43.3	5.88	T.
Seaford	70	23	47.8	2.46	T.
District of Columbia.					
Distributing Reservoir *[5]	72	25	46.5	3.51	
Receiving Reservoir *[5]	71	25	46.0	4.77	
West Washington	76	21	44.3	3.61	T.
Florida.					
Amelia †	80	45	64.3	1.69	
Archer †	82	38	64.5	1.18	
Bartow	85	45	68.5	1.16	
Boca Raton †	83	57	73.8	1.35	
Brooksville †	81	48	67.0	1.18	
Carrabelle †	77	41	62.7	T.	
Clermont †	87	52	69.6	1.18	
De Funiak Springs	81	39	57.0	2.02	
Earnestville	84	47	68.0	1.07	
Estero *[1]	82	52	69.0	0.80	
Eustis †	85	46	67.3	1.22	
Federal Point †	83	47	65.0	2.39	
Fort Meade †	87	44	68.2	0.97	
Frostproof	88	49	70.5	0.50	
Gainesville	81	46	64.3	1.08	
Grasmere †	85	48	67.4	1.31	
Haywood	78	42	61.5	2.34	
Huntington	83	51	66.6	1.78	
Kissimmee		49		0.50	
Lake Butler	86			1.15	
Lake City †	81	44	66.2	0.93	
Lemon City	85	58	74.4	1.15	
Macclenny †	86	41	64.2		
Manatee	84	48	68.4	2.00	
Merritts Island	82	56	71.4	5.99	
Milton *[1]	78	42	60.5	4.88	
Mullet Key †	79	59	70.0	1.03	
Myers †	84	54	71.8	0.73	
New Smyrna	82	49	67.4	5.17	
Oakhill *[1]	86	56	72.7		
Ocala †	83	46	67.2	0.53	
Orange City	83	47	67.2	3.66	
Orange Park	81	42	63.7	0.66	
Orlando †				1.91	
Oxford *† [1]	81	48	65.9	1.72	
Perry	89	36	64.8	2.75	
Plant City	86	45	68.6	1.26	
St. Francis †	85	45	66.2	1.98	
St. Francis Barracks	84	48	66.2	1.40	
Sebastian	87	54	70.5	2.63	
Switzerland *[1]	81	47	63.5	1.73	
Tallahassee †	78	45	61.8	1.02	
Tarpon Springs †	85	45	67.0	1.50	
Wausau	82	36	59.4	1.88	
Georgia.					
Adairsville †	74	28	50.6	1.68	
Alapaha	81	38	60.2	1.81	
Albany †	79	37	59.4	0.55	
Allentown †	79	36	58.3	0.95	
Americus †	78	36	57.6	0.46	
Athens †	73	34	53.6	1.10	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Georgia—Cont'd.	°	°	°	*Ins*	*Ins.*
Belleville	85	37	60.0	1.00	
Blakely †	78	38	60.6	0.65	
Brag	84	31	64.4	0.28	
Canton †				1.95	
Cartersville	75	29	52.2	0.68	
Cedartown	76			0.76	
Clayton †	72	21	48.3	3.99	
Columbus	80	36	57.4	1.13	
Covington	72	29	49.0	1.32	
Crescent	86	38	64.2	0.80	
Dahlonega †	78	26	51.0	3.51	
Diamond	71	22	48.0	2.68	
Elberton †	77	29	54.3	1.65	
Fleming †	80	36	58.2	T.	
Fort Gaines	77	36	57.1	1.47	
Franklin	79	33[i]	54.8*	2.49	
Gainesville	73	29	50.5	3.46	
Gillsville †	78	27	52.8	1.83	
Greenbush	74	25	49.4	1.55	
Hawkinsville	81	26	55.4	0.30	
Hephzibah *† [6]	72	42	56.4	1.00	
Jesup	80	38	60.8	0.78	
Lagrange †	80	31	56.4	1.50	
Louisville	80	35	58.4	0.59	
Lumpkin	79	34	59.2	0.31	
Marietta	74	27	51.2	1.84	
Marshallville †	79	34	59.0	0.70	
Millen	82	42	60.2	2.11	
Morgan †	79	34	57.3	1.58	
Mount Vernon	78	41	61.0	1.10	
Newnan †	72	30	52.3	2.24	
Piscola	80	41	62.8	1.15	
Point Peter	74	27	52.2	3.00	
Poulan †	84	36	59.8	1.20	
Quitman †	82	36	60.7	1.23	
Ramsey	78	25	53.4	1.81	
Resaca				1.32	
Reynolds				0.63	
Rome †	76	28	50.8	1.35	
Talbotton †	75	33	56.0	1.92	
Tallapoosa	74	27	51.3	1.23	
Thomasville †	81	41	62.2	1.65	
Toccoa †	77	27	51.4	3.71	
Washington †				2.80	
Whitesburg †				2.40	
Idaho.					
American Falls	65	15	39.4	1.86	
Blackfoot †	67	15	37.9	0.88	0.5
Boise Barracks †	71	19	41.5	2.34	
Burnside †	58	4	31.5	0.51	
Cœur d'Alene	59	4	35.9		
Corral *[1]	59	12	34.0	1.98	5.5
Downey	61	13	35.5	0.99	0.5
Fort Sherman †	58	2	34.7	8.12	16.2
Gimlet †	64	9	31.8	2.60	9.0
Gray	55	14	36.8	0.16	
Idaho City †	71*	6*	35.6*		8.3
Jansville *[1]	56	10	36.7	2.00	
Kootenai †	59	5	31.0	4.84	31.0
Lakeview	57	9	35.0	8.84	
Lewiston	61	18	40.2	4.20	1.5
Lost River				0.46	3.0
Moscow	59	0	34.4	4.84	
Murray †	55	0	32.0	10.98	62.0
Nampa	72	14	40.6	1.04	0.4
Oakley	67	15	39.8	1.12	2.0
Ola †	63	17	37.8	3.89	4.0
Payette †	72	17	45.3	0.98	T.
Pollock †	68	21	42.4	1.21	
Rexburg	63	13	35.0	0.73	
St. Maries	58	15	36.4	9.78	21.7
Salubria	67	16	38.0	2.78	14.4
Soldier †	63	7	34.4	1.73	5.0
Swan Valley †	63	— 6	33.8	2.48	17.2
Warren †	69	4	32.4	1.71	
Illinois.					
Albion †	72	15	46.0	6.32	
Alexander †	72	9	41.6	3.50	
Ashton *† [1]	68	1	35.9	2.21	0.4
Atwood *a* *† [2]	66	8	37.7	5.83	
Atwood *b*				5.11	
Aurora *a*	68	6	36.6	3.89	0.6
Aurora *b*	69	5	37.1	4.11	0.9
Bloomington †	71	9	40.1	5.00	
Bushnell †	74	7	40.0	2.77	
Cambridge	70	5	37.0	1.89	T.
Carlinville †	72	13	43.6	5.06	
Carlyle				5.43	
Carrollton	71	9	41.3	5.00	
Charleston	67	13	42.3	5.42	
Chemung	67	— 2	33.8	2.37	1.0
Chester				4.50	
Cisne †	72	15	46.5	6.46	
Clearcreek †	71	6	37.4	4.33	
Coatsburg	73	5	40.2	3.10	
Cobden †	75	16	47.5	5.13	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Illinois—Cont'd.	°	°	°	*Ins.*	*Ins.*
Cordova	67	3	38.0	1.79	.....
Danville	69	11	42.0	5.96	T.
Decatur†	71	11	41.6	4.57	T.
Dixon†	72	3	36.8	1.90	0.2
Dwight†	69	9	38.6	4.77	
East Peoria†	74	10	40.1	2.57	T.
Effingham†	70	15	43.8	4.76	
Forrest	72	11	42.6	4.56	0.1
Fort Sheridan†	67	6	36.8	3.53	T.
Friendgrove†	.....	.....	.....	7.01	
Galva†	71	3	37.7	2.00	T.
Glenwood *†[1]	66*	12	38.9*	4.17	T.
Golconda†	74	17	48.6	4.23	
Grafton†	.....	.....	.....	3.81	
Grayville	73	20	49.8	6.41	
Greenville†	68	14	42.2	7.19	
Griggsville†	74	8	42.6	3.38	
Halliday *[5]	70[4]	18[4]	45.0[4]	3.55	
Havana†	73	10	42.4	3.41	
Hillsboro†	71	14	43.1	5.80	
Iron	72	18	47.1	7.22	
Joliet†	72	9	40.5	4.42	T.
Jordans Grove†	73	19	45.7	4.54	
Kankakee *†	65	10	41.4	3.63	.....
Kishwaukee	67	— 2	33.3	1.57	0.5
Knoxville *a*	72	4	37.4	2.47	
Lagrange†	67	8	38.4	3.82	1.0
Laharpe *[1]	73	4	40.2	1.26	
Lanark *†[1]	68	0	34.8	1.79	T.
Lexington	69	8	40.4	4.19	
Loami†	.....	.....	.....	4.93	
Louisville†	70	15	45.2	5.48	
McLeansboro†	73	17	46.8	5.85	
Martinsville†	70	14	43.0	6.01	
Martinton†	70	11	39.7	5.71	
Mascoutah *[5]	72	18	44.2	4.68	
Mattoon *[1]	65	12	39.2	4.73	
Minonk†	70	11	38.6	3.92	T.
Monmouth†	73	2	38.4	1.87	T.
Morrisonville†	67	12	41.0	5.29	
Mount Carmel†	.....	.....	.....	6.69	
Mount Pulaski	70	11	41.4	3.84	T.
Mount Vernon	70	13	47.4	4.00	
New Burnside†	74	11	47.6	4.07	
Olney *a*	74	14	45.2	6.57	
Oswego *[1]	65	5	35.9	3.71	T.
Ottawa†	72	7	38.8	4.37	T.
Palestine†	70	14	43.0	6.33	
Paris	66	14	44.4	6.41	
Peoria *a*†	.....	.....	.....	3.83	T.
Peoria *b*†	71	10	40.4	3.48	
Philo†	69	9	40.3	5.08	
Plumhill†	73	18	45.3	5.48	
Rantoul†	70	9	40.0	3.80	T.
Reynolds	72	1	37.5	1.35	T.
Riley†	65	0	34.6	2.52	0.2
Robinson†	70	14	44.4	7.85	
Rockford	66	0	35.2	1.73	1.5
Roundgrove†	70	0	36.8	1.40	
St. Charles *†[1]	68	5	36.7	3.36	1.0
St. John *†[1]	72	19	45.8	4.70	
Scales Mound	66	— 3	33.3	1.15	0.8
Streator†	69	11	39.3	4.20	T.
Sycamore†	66	2	35.7	3.38	0.2
Tiskilwa †	69	5	37.8	3.36	T.
Tuscola†	69	10	41.5	5.25	
Walnut†	73	4	40.0	2.27	0.1
Wheaton *[3]	.....	6	39.4	2.97	2.0
Winchester *[1]	72	8	40.5	3.87	
Winnebago†	69	— 1	35.2	1.28	1.0
Zion†	65	— 8	32.2	1.55	T.
Indiana.					
Anderson†	67	13	42.6	7.47	T.
Angola *[1]	62	14	38.4	5.60	1.6
Auburn	64	12	39.1	4.22	T.
Bloomington†	68	15	43.4	7.42	T.
Bluffton†	69	12	41.2	5.67	T.
Boonville	.....	.....	.....	5.99	
Bright†	71	15	44.3	8.04	T.
Butlerville†	68	12	44.3	7.65	
Cambridge City†	66	10	42.4	8.70	T.
Columbia City *[1]	61	12	39.0	4.19	
Columbus†	70	11	43.4	7.23	
Connersville†	64	13	41.0	9.15	T.
Crawfordsville	67	14	44.0	8.46	
Delphi†	68	11	39.6	5.84	T.
Edwardsville *†[1]	68	18	47.7	6.62	
Evansville†	74	18	45.5	5.11	
Farmland†	64	14	41.6	7.70	T.
Fort Wayne	65	13	40.3	4.62	T.
Franklin *[1]	68	17	43.1	9.46	
Greencastle†	67	15	43.5	6.93	T.
Greensburg	65	14	44.0	7.85	
Hammond†	63	11	38.8	.....	
Huntington	65	13	39.8	5.68	2.0
Jasper†	70	17	45.7	7.00	
Jeffersonville	70	19	47.3	6.19	
Knightstown†	64	13	41.5	7.93	T.
Knox	66	13	43.9	3.10	T.
Kokomo†	65	15	42.0	6.23	T.
Lafayette†	66	11	41.4	.....	.....
Laporte	65	6	35.4	4.42	
Logansport *b*†	64	14	39.8	5.57	
Marengo†	70	17	45.5	7.45	T.
Marion†	66	11	41.1	5.91	T.
Markle	64	13	38.0	5.10	T.
Mauzy†	63	12	41.2	9.25	T.
Michigan City *[10]	62	10	40.9	.....	
Mount Vernon†	78	19	47.9	5.12	
Northfield †	67	12	41.6	7.17	T.
Princeton *[1]	70	18	45.1	6.63	
Richmond	65	14	43.2	8.23	T.
Rockport	71	20	48.1	4.06	
Rockville†	67	11	42.3	6.10	
Salem	76	18	45.4	5.94	
Scottsburg	70	17	46.3	7.18	
Shelbyville	64	16	42.0	9.84	T.
South Bend†	66	14	40.5	4.66	1.0
Syracuse†	.....	.....	.....	5.26	T.
Terre Haute†	67	16	43.3	7.10	
Topeka†	62	15	39.3	5.23	T.
Valparaiso†	66	12	37.5	3.16	T.
Vevay	70	18	46.9	9.10	
Vincennes†	70	18	44.2	8.45	
Warsaw†	65	11	42.0	5.58	0.5
Washington†	72	17	47.4	8.42	
Winamac	67	9	38.2	.....	
Worthington†	68	16	43.8	7.43	T.
Indian Territory.					
Healdton†	82	16	53.9	T.	
Kemp	83	17	55.2	T.	
Lehigh†	85	14	53.2	T.	
Purcell†	80	12	53.8	1.35	
South McAlester†	.....	.....	.....	1.22	
Tahlequah	79	20	48.7	1.38	
Tulsa†	.....	.....	.....	1.29	
Wagoner	81	16	48.3	1.19	
Iowa.					
Adair	.....	.....	.....	0.05	0.5
Afton	71	— 3	36.1	0.34	T.
Albia	81	— 3	38.8	0.52	T.
Algona *[1]	71	—11	30.4	0.32	3.8
Alta *a*†	70	— 9	31.0	0.47	3.0
Amana†	69	— 3	34.1	0.88	T.
Ames *b*.	75	— 4	34.2	0.49	T.
Ames (near)	.....	.....	.....	0.32	0.8
Atlantic†	72	— 4	32.6	T.	T.
Audubon	68	— 7	32.4	0.40	1.5
Belknap	74	1	38.1	0.93	T.
Belleplaine	68	—10	30.8	0.94	0.7
Bonaparte†	76	1	38.2	1.50	
Britt	74	—17	30.1	0.25	2.8
Burlington	74	3	40.0	1.82	T.
Carroll	71	— 9	32.6	0.25	2.5
Cedar Falls	74	— 8	32.4	0.51	T.
Cedar Rapids†	73	— 2	35.6	0.55	0.4
Chariton	73	1	38.0	1.09	T.
Charles City	69	—13	31.0	0.74	4.5
Clarinda†	72	0	37.7	0.37	0.2
Clinton	69	0	36.2	2.09	1.0
College Springs	72	— 3	38.2	0.44	
Corning†	72	— 2	37.9	0.18	T.
Council Bluffs	76	— 3	34.4	0.05	T.
Cresco†	71	—13	28.6	0.44	2.4
Decorah†	70	—11	30.4	0.60	3.0
Delaware *[3]	70	— 4	30.8	1.05	
Denison†	74	—10	35.8	0.05	0.5
De Soto	70	— 2	34.6	0.45	0.7
Dows	75	—13	31.2	0.56	3.5
Eldora	78	—12	32.8	0.71	2.0
Elkader†	75	— 5	32.8	0.99	0.5
Estherville	70	—11	30.0	0.10	1.0
Fairfield†	76	0	37.9	1.22	
Fayette†	72	— 8	31.7	1.08	1.2
Fonda	70	— 7	35.6	.....	.....
Forest City	72	—11	31.8	0.20	2.0
Fort Madison *†[1]	69	9	41.5	2.24	T.
Fredericksburg	.....	.....	.....	0.50	T.
Gardengrove	73	— 4	34.8	0.75	T.
Glenwood†	71	— 2	38.2	T.	T.
Grand Meadow *[1]	68	— 6	31.5	0.88	2.0
Greene	74	—13	32.2	0.52	1.0
Greenfield	72	— 5	35.2	.....	.....
Grinnell	70	— 4	35.6	0.58	2.2
Grundy Center	73	— 8	32.1	0.40	0.5
Guthrie Center	69	— 5	34.2	0.35	0.2
Hampton	74	—10	30.5	0.71	2.8
Hawkeye	.....	.....	.....	0.87	3.0
Hedrick *[1]	64*	12*	39.3*	0.35*	T.
Hopeville†	72	— 3	36.1	0.63	T.
Humboldt†	73	—12	32.0	0.40	4.0
Independence†	70	— 9	30.4	0.36	0.4
Indianola †	76*	— 2	40.2*	0.72	T.
Iowa City *a*	81	2	37.4	1.98	T.
Iowa City *b*.	70	— 2	36.3	.....	.....
Iowa Falls†	73	—12	31.0	0.47	.....
Keosauqua	71	4	39.6	1.80	T.
Knoxville	73	5	37.2	0.65	1.0
Lamoni	69	— 1	37.9	0.51	
Lansing	74[3]	— 6	31.2*	0.81	2.2
Larrabee†	67	—12	30.8	0.35	2.2
Leclaire	.....	.....	.....	1.42	
Lemars	70	— 6	33.2	0.35	2.0
Lenox *[1]	72	— 2	36.1	0.39	0.3
Logan†	71	—10	33.6	0.30	2.0
Malvern	.....	.....	.....	0.30	0.3
Maple Valley	.....	.....	.....	0.70	5.0
Maquoketa	68	0	36.0	1.06	T.
Marshall†	75	— 5	35.6	0.68	0.5
Mason City	72	—14	28.0	0.10	1.0
Millman	.....	.....	.....	0.35	T.
Monticello	66	— 2	33.8	1.04	0.5
Mooar	76	4	38 3	1.83	
Mountayr†	73	— 3	36.5	0.92	0.2
Mount Pleasant *[1]	70	4	39.2	1.64	0.2
Mount Vernon *a*[1]	69	3	35.0	0.93	.....
Mount Vernon *b*.	67	— 3	34.2	0.95	0.4
Newton†	74	— 3	34.1	0.38	0.5
North McGregor	.....	.....	.....	0.75	1.0
Northwood	72	— 9	29.6	0.30	3.0
Odebolt	70	— 9	33.2	0.30	1.5
Ogden	75	—10	35.1	0.29	1.3
Osage *[3]	70	—10	27.0	0.33	2.5
Osceola	75	— 4	37.0	0.57	T.
Oskaloosa†	75	— 2	37.2	0.15	
Ottumwa	72	2	39.1	1.11	.....
Ovid†	76	— 5	35.7	0.54	T.
Plover	68	—10	30.8	0.05	0.5
Primghar	69	—14	31.9	0.85	6.5
Red Oak	71	— 3	37.4	0.18	1.4
Rock Rapids	70	—19	28.0	0.25	2.5
Rockwell City	66	—16	28.8	0.11	0.2
Sac City†	68	— 7	31.8	0.20	2.0
Seymour†	75	— 2	38.4	2.03	
Sibley	72	—15	30.4	0.20	2.0
Sidney	69	— 2	35.4	0.26	0.2
Sigourney	75	— 2	36.9	1.37	T.
Spencer	70	—14	29.5	.....	.....
Spirit Lake†	73	—15	30.7	.....	.....
Stuart	70	— 4	36.1	0.18	0.5
Thurman	73	— 3	36.2	0.07	T.
Toledo	70	— 5	38.6	0.35	
Villisca†	71	— 2	36.0	0.34	0.1
Vinton *[1]	72	— 5	33.8	0.42	T.
Washington	76	— 4	35.6	.....	.....
Washta	.....	.....	.....	0.37	3.0
Waterloo	72	— 7	32.8	0.62	0.5
Waverly	72	— 8	33.0	0.65	2.0
Webster City	70	— 8	33.2	0.20	2.0
Westbend *†[1]	71	—15	28.6	0.74	6.0
West Branch	70	— 2	35.0	1.89	T.
Whitten *[1]	71	— 8	31.0	.....	.....
Wilton Junction †	71	0	36.2	2.00	T.
Winterset†	74	— 5	34.6	0.56	
Kansas.					
Abilene†	77	3	42.4	0.23	
Achilles	.....	.....	.....	0.20	1.0
Altoona *†[3]	75	7	40.4	0.31	
Anthony	.....	.....	.....	T.	
Assaria *[5]	75	4	43.3	T.	T.
Atchison †	82	2	42.4	1.32	
Beloit†	76	3	41.4	0.42	
Burlington†	82	3	42.9	0.17	
Campbell	75	0	40.0	0.68	
Chanute	80*	8*	46.8*	0.00	
Colby†	78	1	39.4	0.18	T.
Columbus	76	10	45.4	1.23	
Coolidge† *z*	80	15	43.7	T.	
Cunningham† *d*	84	14	45.6	0.06	
Dresden *[1]	78[3]	4[3]	37.4[3]	0.15	0.5
Ellinwood†	83	2	41.4	0.09	T.
Englewood†	89	4	42.2	0.01	
Eskridge	78	2	42.7	1.00	
Eureka Ranch†	80	— 1	39.2	0.07	T.
Fall River	82	8	46.4	0.33	
Fort Riley †	78	3	43.2	0.27	
Fort Scott†	79	6	45.6	0.80	
Frankfort	79	0	41.4	0.75	T.
Garden City†	82	8	41.6	T.	T.
Garfield	.....	.....	.....	0.23	T.
Gibson	88	0	39.0	0.11	
Gove *†[1]	82	6	37.6	0.15	T.
Grainfield *[3]	60	4	41.0	T.	T.
Grenola	83	7	44.5	0.21	
Halstead	76	0	40.6	0.22	
Horton	80	1	40.8	0.63	T.
Hoxie	72	0	37.4	0.00	
Lakin†	82	6	43.4	T.	T.

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Kansas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Lawrence	80	4	43.2	0.72	
Lebo†	83	2	43.2	0.17	
McPherson	76	0	43.2	0.08	
Manhattan *b*	80	4	42.0	0.54	
Manhattan *c*	80	4	42.6	0.57	
Marion†	77	6	45.8	0.20	
Meade†	86	10	48.4	0.00	
Medicine Lodge†	88	8	44.0	0.02	
Minneapolis†	78	2	42.0	0.18	T.
Morantown†	77	5	44.4	0.33	
Morland	85	0	39.4	T.	T.
Mounthope *[1]	79	6	43.8	0.22	
Ness City	76[d]	6[d]	43.6[d]	0.00	
Newton	82	5	45.2	0.27	
Norton	74	2	38.0	0.00	
Norwich†	85[d]	8[e]	45.0[d]	0.08	
Oberlin†	.....	.....	.....	0.50	2.0
Olathe†	80	2	42.5	0.84	
Osage City†	83	1	44.4	0.37	
Oswego	79	10	49.7	0.93	
Ottawa	81	4	43.6	0.55	
Phillipsburg	68	0	37.6	0.10	T.
Pleasant Dale	82	2	41.4	T.	T.
Pratt	74	18	41.4	0.20	T.
Rome *† [1]	80	9	45.4	0.02	
Russell	.....	.....	.....	0.41	
Salina†	75	1	41.6	0.01	T.
Scott City	.....	.....	.....	0.00	
Sedan†	81	8	45.3	0.19	
Seneca	80	2	40.4	0.28	T.
Sharon Springs *[1]	92	12	42.8	0.40	4.0
Toronto	85	4	44.8	0.35	
Ulysses†	85[d]	2[d]	38.8[d]	T.	T.
Viroqua†	80	9	41.7	0.00	
Wallace *[1]	80	6	36.0	0.25	4.0
Wamego *[1]	80	4	40.0	0.50	
Wellington *[1]	78	10	48.2	T.	
Winona *[1]	90	10	46.1	0.00	
Kentucky.					
Alpha	.....	.....	.....	4.13	
Ashland	72	19	46.4	4.36	
Bardstown†	.....	30	.....	4.73	
Blandville†	72	18	46.8	6.65	
Bowling Green *a* *[1]	74	16	45.8	3.23	
Bowling Green *b* †	73	21	48.8	3.15	
Burnside†	.....	.....	.....	3.32	
Caddo	.....	.....	.....	8.56	T.
Canton *† [1]	78	26	49.9	4.03	
Carrollton†	68	19	47.0	8.11	
Catlettsburg *† [1]	67	20	44.3	4.83	
Earlington *[1]	72	21	48.5	4.83	
Edmonton†	72	20	49.0	3.74	
Ensor	72	19	48.4	4.79	
Eubank	74[g]	14[g]	48.8[g]	2.34	
Falmouth†	.....	.....	.....	8.49	
Fords Ferry	76	19	48.7	4.83	
Frankfort†	73	20	48.8	5.31	
Franklin *[1]	72	20	48.6	.....	
Georgetown	70	16	48.2	.....	
Greensburg †	76	17	48.1	3.77	
Henderson †	74	20	48.6	4.69	
Hopkinsville †	75	21	49.6	3.49	
Irvington	71	18	47.4	5.21	
Leitchfield †	72	17	45.6	4.35	
Loretto	74	12	47.3	3.72	
Lyndon	.....	.....	.....	4.06	
Marrowbone†	76	16	47.4	4.34	
Middlesboro†	71	16	46.6	2.38	
Mount Hermon	72	18	49.2	3.75	
Mount Sterling†	69	18	46.2	4.70	
Owensboro†	75	21	49.2	4.60	
Owenton†	67	16	45.8	9.29	
Paducah *a* †	.....	.....	.....	5.74	
Paducah *b* †	78	21	49.4	4.69	
Pleasure Ridge Park †	72	18	46.5	6.23	
Princeton	75	20	47.3	4.55	
Richmond †	73	17	49.5	3.02	
Russellville †	75	18	49.7	2.45	
St. John†	73	17	46.2	4.46	
Sandyhook	.....	.....	.....	2.44	
Scott	67	17	46.0	7.67	T.
Shelby City	73	15	47.1	3.88	
Shelbyville†	71	16	46.0	5.74	
Southfork[5]	.....	.....	45.2	2.94	
Vanceburg	69	16	45.0	.....	
Williamsburg†	76[j]	20	48.4[e]	3.10	
Louisiana.					
Abbeville	86	35	63.0	4.00	
Alexandria†	81	28	58.0	4.62	
Amite†	84	35	60.7	5.90	
Bastrop †	83	26	58.2	2.99	
Baton Rouge†	84	37	61.0	4.08	
Calhoun	83	26	54.0	1.12	
Cheneyville †	86	30	57.4	3.61	
Clinton †	79	34	59.0	2.47	
Covington	82	33	61.0	1.32	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Louisiana—Cont'd.	°	°	°	*Ins.*	*Ins.*
Donaldsonville†	86	36	63.1	5.08	
Emilie†	81	40	60.6	3.31	
Farmerville	81	35	54.6	2.63	
Franklin†	80	40	62.1	4.01	
Grand Coteau	80	38	60.6	3.85	
Hammond	79	34	56.8	2.56	
Houma †	86	37	65.5	1.25	
Jeanerette	85	36	62.2	7.39	
Jennings	85	36	63.1	2.78	
Lafayette †	84	32	60.9	2.62	
Lake Charles†	87	38	61.9	2.37	
Lake Providence	89	29	58.7	.....	
Lawrence	89	44	64.9	0.93	
Liberty Hill	86	38	57.5	1.77	
Mansfield †	82	25	56.0	0.75	
Melville	83	32	61.8	4.60	
Minden	84[d]	29[d]	56.2[d]	3.14	
Monroe†	84	25	56.5	2.33	
Montgomery	83	27	57.5	2.70	
New Iberia	79	35	60.9	2.80	
Oakridge†	83	33	58.1	3.04	
Oberlin	83	32	58.8	2.87	
Opelousas	84	34	60.2	5.95	
Oxford†	84	27	57.0	1.82	
Paincourtville†	83	35	61.6	3.18	
Plain Dealing†	84	30	57.5	1.75	
Plaquemine	89	38	63.9	2.02	
Rayne	85[c]	36[c]	63.6[c]	5.20	
Robeline	84	23	55.6	4.74	
Ruston	81	32	57.5	1.42	
Schriever	86	34	62.2	2.93	
Shellbeach	80	40	63.0	3.68	
Southern University†	83	40	62.0	3.20	
Sugar Ex. Station†	80	42	61.2	3.37	
Sugartown†	82[f]	38[f]	62.3[f]	2.14	
Venice†	85	52	66.8	0.65	
Wallace	83	39	62.6	3.13	
Whitehall	88	36	62.5	5.75	
White Sulphur Springs.	86	28	59.7	2.45	
Maine.					
Bar Harbor	67	7	36.8	9.25	9.5
Belfast *[6]	54	7	33.8	5.75	7.0
Cornish *[1]	58	5	33.0	6.36	8.0
Fairfield	57	4	33.8	3.98	5.0
Farmington	.....	.....	.....	5.01	11.2
Fort Fairfield	55	— 1	31.6	3.10	7.0
Gardiner	59	8	35.5	5.99	6.2
Kineo†	54[d]	3[d]	28.5[d]	2.69	8.0
Lewiston	62	12	35.4	5.92	8.8
Mayfield	53	— 2	28.9	5.12	13.0
North Bridgton	58	8	34.0	5.79	8.0
Orono	59	3	33.2	5.04	6.0
Maryland.					
Annapolis	71	29	50.8	4.98	
Bachmans Valley	68	22	43.8	8.43	T.
Boettcherville	76	18	43.6	4.60	
Charlotte Hall †	78	24	48.5	3.19	
Cherryfields † [2]	.....	.....	47.2	1.72	
Chestertown †	64	26	44.4	5.58	T.
Collegepark	.....	.....	.....	3.98	
Cumberland *b*	71	24	47.6	4.85	T.
Darlington †	69	24	44.2	4.82	
Deerpark	66	5	38.0	5.84	2.0
Easton †	72	24	45.9	3.40	T.
Ellicott City	74	23	44.2	5.85	
Fallston	69	23	44.4	5.32	T.
Flintstone	74	17	48.2	4.84	T.
Frederick	69[i]	26	45.6[e]	5.01	T.
Grantsville	67	8	38.6	6.20	2.0
Greatfalls	74	20	43.8	4.07	
Greenspring Furnace	68	17	42.6	4.75	T.
Hagerstown †	70	24	45.4	4.96	
Jewell †	.....	24	.....	2.91	
Johns Hopkins Hospital	75	24	44.7	5.15	
Laurel	67	22	45.0	5.15	
Mardela Springs †	73	23	48.0	2.83	T.
Mount St. Marys Coll. †	68	21	42.8	6.15	T.
New Market	68	24	43.7	6.69	
Pocomoke City	78	28	53.9	1.59	
Port Deposit	70	.....	.....	5.40	
Princess Anne	73	23	47.0	2.81	T.
Sharpsburg	69	21	42.8	4.59	T.
Smithsburg	65	22	45.7	5.23	T.
Solomons †	74	27	49.9	1.90	
Sunnyside	69	9[f]	39.0[e]	8.14	2.5
Taneytown †	70	23	43.8	6.04	T.
Van Bibber	71	25	43.2	4.94	
Western Port	67[c]	18[c]	41.2[c]	3.95[c]	0.2
Westminster	71	20	45.5	6.71	
Woodstock	73	26	44.0	6.50	T.
Massachusetts.					
Amherst	65	4	38.1	5.79	6.5
Bluehill (summit)	64	7	39.0	6.77	9.0
Cambridge *a*	68	8	40.9	6.45	.....
Chestnut Hill	68	6	40.6	6.74	7.0
Fallriver	62	12	42.0	8.22	7.5

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Massachusetts—Cont'd.	°	°	°	*Ins.*	*Ins.*
Fitchburg	67	6	36.9	6.91	6.6
Framingham	65	8	40.2	6.45	.....
Groton	64	4	36.4	7.77	11.0
Hyannis *† [1]	64	13	42.6	7.96	7.5
Lawrence	66	8	38.4	6.05	1.8
Lowell *a*	64	10	38.3	6.49	.....
Middleboro	67	1	39.8	6.95	8.2
Monson	65	4	39.4	7.21	10.0
New Bedford *a*	66	11	42.4	9.74	6.0
Springfield Armory	69	9	40.4	5.15	5.0
Taunton *b*	66	5	39.0	8.52	7.0
Westboro†	66	3	39.6	6.55	9.0
Worcester *b*	63	10	38.8	6.92	8.0
Michigan.					
Adrian	63	14	37.3	4.02	0.2
Allegan	60	13	37.8	1.48	1.0
Alma	63	15	35.2	2.45	1.5
Ann Arbor	62	14	36.7	4.79	.....
Arbela	62	14	36.6	3.68	T.
Baldwin	64	0	33.3	2.86	5.2
Ball Mountain	60	13	37.0	3.33	0.5
Battlecreek	64	16	38.1	4.08	1.1
Bay City *b*	.....	14	.....	2.30	T.
Benton Harbor	65	18	39.9	4.16	T.
Benzonia	66	13	41.2	.....	.....
Berlin	61	11	34.5	3.86	1.0
Berrien Springs	66	17	39.6	5.25	0.5
Big Rapids	62	9	33.0	2.49	0.4
Birmingham	61	12	35.8	5.15	.....
Boon	60	3	31.4	2.44	3.8
Calumet	53	5	27.2	1.18	13.0
Camden	62	14	38.0	5.23	T.
Carsonville	59	15	35.3	3.15	0.1
Charlevoix	67	17	35.8	2.40	11.0
Cheboygan	57	12	32.9	1.71	9.0
Clinton	67	15	37.7	5.33	T.
Coldwater	62	14	37.8	5.48	.....
Crisps *[10]	52	10	33.2	.....	.....
East Tawas	63	9	34.6	1.14	.....
Eloise	62	14	38.0	5.04	T.
Escanaba†	54	0	30.3	1.50	6.5
Ewen	57	—10	26.2	1.75	11.5
Fairview	61	15	37.6	3.99	T.
Fitchburg	60	10	35.3	6.03	2.5
Flint	62	14	36.4	3.12	0.2
Frankfort *[10]	55	20	39.5	.....	.....
Gladwin	60[d]	14	33.4	0.85	3.0
Grand Point au Sable *[10]	55	15	36.6	.....	.....
Grand Rapids *b*	65	11	36.1	2.56	1.4
Grape	64	16	39.0	4.31	0.5
Grayling	60	5	31.4	1.39	11.2
Grindstone City *[10]	58	18	36.4	.....	.....
Hammonds Bay *[10]	58	18	34.4	.....	.....
Hanover	65	12	37.0	5.42	1.8
Harrison	64	10	34.6	1.88	6.8
Hart	61	14	36.4	2.08	1.6
Hastings	64	12	36.6	3.07	0.5
Hayes	61	16	36.6	1.83	.....
Highland Station	.....	.....	.....	4.74	
Hillsdale	62	15	37.2	4.92	T.
Holland *[10]	62	21	40.9	.....	
Howell	62	14	36.0	4.04	T.
Humboldt	55	— 7	24.0	1.19	6.0
Ionia	64	14	36.4	2.53	T.
Iron River	58	—17	23.2	1.24	11.0
Ivan	60	11	33.4	1.69	5.7
Jackson	63	16	37.8	4.63	
Jeddo	60	14	36.0	4.93	0.2
Kalamazoo	63	16	39.2	4.01	3.5
Lake City	68	10	34.0	.....	2.0
Lansing	63	14	36.4	3.13	1.0
Lapeer	.....	14	.....	3.06	0.5
Lathrop	56[b]	— 2[c]	29.6[c]	2.24	7.0
Ludington	59	14	36.7	2.21	4.2
Luzerne	60	6	30.2	1.68	8.8
Mackinaw City	60	15	31.6	2.45	15.0
Madison	64	15	37.9	4.02	0.8
Mancelona	60	8	32.2	3.64	22.2
Manistee	60	13	34.4	3.25	6.5
Manistique	55	3	30.0	2.98	14.5
Middle Island *[10]	55	19	36.7	.....	
Midland	64	12	36.0	1.75	T.
Mottville	65	14	38.6	5.50	1.0
Mount Clemens	69	14	36.8	4.13	
Mount Pleasant *b*	63	13	34.2	1.87	T.
Muskallonge Lake *[10]	51	6	31.8	.....	
Muskegon	61	14	37.6	1.76	1.5
Newberry	60	2	28.8	2.16	6.4
North Manitou Island *[10]	54	17	35.4	.....	
North Marshall	63	10	36.3	4.41	T.
Northport	62	17	35.2	3.08	2.4
Old Mission	63	16	35.6	1.40	6.8
Olivet	61	15	37.0	4.26	0.8
Omer	63[c]	15	34.5	1.44	
Ottawa Point *[10]	60	16	36.3	.....	
Ovid	64	14	36.6	2.82	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
Owosso	65	13	36.8	2.79	
Parkville	...	.....	.....	4.85	2.5
Pentwater *10	61	17	40.3	.....	
Petoskey	58	17	33.8	2.37	10.0
Plymouth	63	17	37.2	4.91	T.
Point Au Barques *10	64	12	37.4	.....	
Point Betsey *10	55	17	37.5	.....	
Port Austin	64	17	37.0	1.48	T.
Reed City	63	10	32.0	2.59	1.4
Rockland	65	− 5	26.0	2.77	18.6
Rogers City	58°	11	33.5	1.97	.....
Romeo	61	13	37.6	4.33	T.
Saginaw	65	10	35.4	2.75	T.
St. Ignace	52	11	31.7	1.66	8.0
St. Johns	66	13	37.4	2.55	
Sandbeach *a*	62	15	36.6	1.50	
Ship Canal *10	52	10	29.6	.....	
Sidnaw	56	−10	25.4	1.75	13.5
Somerset	62	13	36.0	4.87	2.0
South Haven	.....	.....	.....	2.66	
Stanton	66	11	34.8	1.72	0.5
Sturgeon Point *10	56	14	36.0	.....	
Thomaston	56	−10	24.8	2.86	18.0
Thornville	60	15	37.6	3.31	1.0
Thunder Bay Island *10	60	18	36.5	.....	
Traverse City	.....	.....	.....	1.19	8.0
Two Heart River *10	52	6	31.0	.....	
Valley Center	60	10	34.0	4.09	.....
Vandalia	65	15	38.9	4.98	0.7
Vassar	64	12	36.8	1.88	T.
Vermillion Point *10	50	4	27.6	.....	
Wasepi	61	12	38.4	4.74	1.0
Waverly	64	10	36.8	4.06	1.6
West Harrisville	66°	14°	35.4°	0.75	0.7
Wetmore	55	− 3	27.4	3.76	30.0
White Cloud	62	12	32.8	2.68	1.5
Ypsilanti	64	14	38.2	5.80	0.6
Minnesota.					
Ada†	59	−15	21.2	0.04	0.2
Albert Lea	72	−11	30.2	0.49	4.5
Alexandria†	63	−11	26.6	0.73	3.0
Beardsley	67	−13	26.0	0.71	2.5
Bird Island	71	−17	27.7	0.52	3.0
Blooming Prairie†	67	−13	27.8	0.35	3.5
Bonniwell	60	−12	29.4	0.88	7.0
Caledonia†	68	−10	30.5	0.63	3.0
Camden	73	−11	28.1	0.75	6.0
Collegeville	62	− 2	29.2	0.35	.....
Crookston†	54	−12	20.8	0.20	T.
Detroit City	60	−18	21.5	0.20	T.
Faribault	74	−14	29.3	0.40	4.0
Farmington†	70	−16	24.8	0.80	6.0
Fergus Falls†	56	−10	25.0	0.28	1.6
Glencoe	71	−15	28.8	0.39	
Glenwood	60	−13	25.1	1.03	1.0
Grand Meadow†	70	−12	26.8	0.38	5.0
Koochicking	52	−22	18.8	0.73	4.5
Lake City	71	−11	30.0	0.29	5.0
Lakeside†	72	−17	26.8	0.41	4.0
Lake Winnibigoshish	54	−12	20.7	.....	.....
Lambert†	50	−13	20.0	0.10	1.0
Leech Lake	59	−13	22.4	0.24	1.9
Lesueur *1	68	−12	28.9	0.45	3.5
Long Prairie	60	−10	25.0	0.52	2.2
Lutsen	48	− 6	25.8	0.87	.....
Luverne†	79	−13	29.8	1.00	3.5
Lynd	73	−15	27.4	.....	.....
Mapleplain	.....	.....	.....	1.01	6.9
Maplewood *1	68	− 3	29.7	.....	.....
Milan†	73d	−20d	24.1d	0.53	4.5
Minneapolis *g*	69	−10	28.5	0.97	4.9
Minneapolis *b*1	68°	−10	26.7	0.87	5.2
Minnesota City *†1	70	−10	31.2	0.53	4.0
Montevideo†	74	−17	27.8	0.56	5.0
Morris	62	−12	26.4	0.38	1.5
New London	60	−14	25.7	0.32	4.0
New Richland *1	68d	−13d	29.5d	.....	.....
New Ulm†	72	− 9	28.6	0.51	5.0
Park Rapids†	60	−14	22.0	0.38	3.3
Pine River1	52	−10°	24.0	0.53	6.0
Pleasant Mounds	75	−10	31.0	0.34	3.3
Pokegama Falls	59	−13	19.5	0.35	2.3
Redwing	.....	...	.....	1.78	.....
Reeds	.....	.....	.....	0.19	0.3
Rolling Green	68	−10	29.0	0.20	2.0
Roseau	56	−14	17.0	0.77	4.0
St. Charles†	74	−11	30.5	0.64	4.8
St. Cloud	56	−14	24.6	0.60	6.0
St. Olaf	57	− 9	25.0	0.22	2.5
St. Peter	69	− 8	33.2	0.20	2.0
Sandy Lake Dam	59	−13	22.2	0.32	3.0
Shakopee6	64°	−12	28.6	0.69	4.2
Spring Park	.....	.....	.....	0.85	4.6
Tower†	50	−15	18.4	1.30	5.0
Two Harbors†	55	− 4	27.5	0.52	1.0
Wabasha *1	69	− 8	30.2	0.65	6.5

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Minnesota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Willmar†	68	−18	26.4	0.10	1.0
Worthington	72	−11	29.2	0.43	2.2
Zumbrota1	68°	−16	28.8	.....	.....
Mississippi.					
Agricultural College	78	26	55.0	0.72	
Austin†	80	24	53.0	5.69	
Batesville†	79	25	52.0	2.89	
Bay St. Louis	80	39	61.5	4.39	
Biloxi†	78	39	60.6	1.67	
Briers	78	32	57.2	1.52	
Brookhaven†	83	28	58.6	3.63	
Canton†	81	28	57.6	1.30	
Columbus *a*†	.....	.....	.....	2.13	
Columbus *b*†	80	26	55.0	.....	
Corinth	76	25	52.3	6.44	
Crystal Springs†	80	27	57.6	1.85	
Edwards	80	30	57.2	1.29	
Enterprise	81	29	58.1	0.97	
French Camps	80	32	53.9	1.61	
Greenville *a*	75	29	53.1	3.67	
Greenville *b*†	82	27	55.2	2.96	
Greenwood	78	25	54.0	1.00	
Hattiesburg†	79	33	58.6	1.42	
Hazlehurst†	80	29	56.7	...	...
Holly Springs†	76	24	49.7	3.99	
Jackson†	80	28	54.6	3.17	
Lake†	76	29	51.7	0.98	
Leakesville†	85	33	61.0	2.29	
Logtown†	80	38	61.6	3.80	
Louisville†	81	24	55.4	1.36	
Macon†	79	26	54.6	1.11	
Magnolia†	83	33	57.4	3.03	
Mayersville	80	29	56.0	1.03	
Meridian†	81	29	56.5	1.79	
Natchez†	84	32	60.4	3.75	
Okolona†	78	25	53.1	2.50	
Palo Alto	89	25	54.5	0.76	
Pontotoc	88	24	56.8	2.07	
Port Gibson†	83	26	57.6	3.37	
Rosedale6	80	25	50.0	.....	
Stonington *1	80	30	58.0	.....	
Tupelo†	.....	.....	.....	2.75	
University	79	23	52.7	2.58	
Water Valley *†1	78	25	52.5	1.30	
Waynesboro *b*†	89	30	59.7	2.95	
Woodville†	79	33	59.7	4.31	
Yazoo City†	84	26	55.8	2.53	
Missouri.					
Appleton City	78	7	46.0	1.62	
Arthur *3	.....	10	41.2	1.05	
Avalon	77d	1°	39.0d	1.76	
Bethany	76	1	39.6	1.23	
Birchtree	77	11	43.4	2.17	
Bolckow	.....	.....	.....	0.31	T.
Boonville†	.....	.....	.....	1.92	
Brunswick	76	5	40.8	2.25	
Carrollton†	78	7	43.4	2.16	
Conception	75	3	39.8	0.27	T.
Cowgill *5	74	2	39.4	1.68	T.
Darksville†	70	5	39.6	2.30	
Downing	.....	.....	.....	1.32	
East Lynne *3	.....	10	41.8	1.12	
Edgehill *5	70	16	43.1	4.21	
Eightmile *1	78	5	42.6	1.13	
Eldon *1	79	10	42.9	3.40	
Elmira	79	0	42.6	1.33	
Emma *3	.....	8	40.2	1.11	
Fairport	.....	.....	.....	1.07	
Farmersville	.....	.....	.....	1.66	
Fayette	80	6	43.8	1.98	
Fulton	.....	.....	.....	2.93	
Gallatin *1	76	2	41.0	1.31	
Glasgow	78	4	42.2	1.56	
Gordonville *3	... ..	19	44.2	2.59	
Gorin	.....	.....	.....	1.80	
Halfway	75	11	45.5	1.79	
Harrisonville†	78	5	41.7	0.72	
Hastain	73	14	43.3	2.09	
Hermann†	.....	.....	.....	3.87	
Houston	79	15	46.4	2.40	
Houstonia	.....	.....	.....	2.12	
Humansville	78	11	47.3	2.25	
Irena	.....	.....	.....	0.67	T.
Ironton†	77	12	44.7	3.92	
Jefferson City†	75	11	45.8	4.16	
Kidder	79	− 1	40.4	1.54	T.
Lamar†	80	10	45.6	1.95	
Lamonte	.....	.....	.....	1.92	
Lebanon	77	14	46.6	2.41	
Lexington	80	5	43.8	1.80	
Liberty	80	3	43.4	1.00	
McCune *†1	78	10	41.7	3.57	
Mansfield	.....	.....	.....	2.10	
Marblehill	74	13	46.0	4.21	
Marshall†	78	5	41.6	2.03	
Maryville	77	− 3	36.4	0.38	T.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Missouri—Cont'd.	°	°	°	*Ins.*	*Ins.*
Mexico†	77	4	42.0	2.75	
Mineralspring	75	13	47.2	1.72	
Montreal *1	76	12	44.2	2.89	
Mount Vernon	80	15	49.8	2.04	
Neosho	75	14	48.6	1.78	T.
Nevada *5	79	9	44.8	0.69	
New Haven *1	73	12	46.3	3.46	
New Madrid	78	21	52.0	4.78	
New Palestine *†1	74	10	45.3	2.42	
Oakfield	74	13	45.4	5.94	
Oakmound	.....	.....	.....	3.03	
Oakridge *4	.....	24	42.2	3.48	
Olden†	76	14	45.2	1.59	
Oregon *a*	81	2	40.3	0.61	T.
Oregon *b*	80	0	41.2	0.45	T.
Osceola†	.....	.....	.....	2.65	
Oto	.....	.....	.....	2.00	
Palmyra *5	76	6	41.4	2.92	
Phillipsburg *†1	74	12	43.0	2.10	
Pickering *3	.....	− 3	36.8	0.40	T.
Platte River *3	74	3	36.6	1.39	
Poplar Bluff	76b	17d	49.2c	4.93	
Potosi	71	5	39.2	5.07	
Princeton	79	0	39.6	1.82	
Rhineland	76	14	45.0	3.50	
Richmond	80	4	42.4	2.13	
Rolla	.....	.....	.....	3.16	
St. Charles	74	14	43.9	4.74	
St. James *3	.....	15	42.8	.....	
St. Joseph†	.....	.....	.....	0.92	
St. Louis	75	15	43.8	5.23	T.
Sarcoxie *3	.....	10	40.2	2.17	
Sedalia	75	11	43.8	1.51	
Seymour *1	74	14	42.2	2.07	
Shelbina	.....	.....	.....	3.10	
Sikeston	77	20	46.5	5.16	
Steffenville	76	20	43.5	2.17	
Stellada†	76	6	43.9	1.62	
Sublett	74	2	38.6	1.43	T.
Trenton	72	3	40.8	1.56	
Vichy	75	11	43.1	5.65	T.
Virgil City	.....	.....	.....	2.57	
Warrenton	76	10	41.9	4.31	
Wheatland	.....	.....	.....	4.02	
Willow Springs	76	10	43.5	2.21	
Zeitonia *1	82	20	49.1	2.67	
Montana.					
Bigtimber	70	−17	29.9	1.88	19.2
Billings	70	−20	26.6	2.44	13.5
Bozeman†	63	−12	28.3	.....	.....
Bozeman Exper. Stat'n.	65	− 9	29.8	.....	.....
Butte†	66	− 4	30.4	1.52	10.5
Castle	61	− 9	27.4	1.88	18.8
Chinook†	55	−22	16.2	1.85	17.0
Columbia Falls	55	−14	28.9	10.04	47.0
Deer Lodge	67	−11	28.0	1.53	10.6
Fort Benton	77	−25	25.8	1.10	11.0
Fort Keogh†	75	−27	25.4	0.98	9.8
Fort Logan†	60	−27	25.8	2.59	.....
Fort Missoula	68	2	32.4	2.30	9.3
Glasgow	73	−30	17.2	0.68	.....
Glendive†	72	−17	25.4	1.00	10.0
Glenwood	61	−13	25.7	2.71	27.0
Greatfalls†	68	−23	25.7	1.55	14.1
Hogan†	59	−20	21.2	2.14	21.0
Kipp†	67	−35	18.0	5.51	30.9
Lewistown	71	−24	25.4	3.97	42.5
Livingston†	67	− 5	32.1	1.66	14.0
Manhattan†	65	−16	28.0	0.44	4.5
Martinsdale†	65	−10	28.6	3.15	20.5
Marysville†	65	− 9	27.4	2.53	21.0
Poplar	71	−25	20.2	1.10	10.0
Radersburg	.....	.....	.....	1.23	5.2
St Ignatius Mission	64	0	34.4	4.04	10.8
St. Pauls†	.....	.....	.....	1.13	11.3
Troy	.....	− 5	.....	9.34	22.0
Utica†	67	−21	28.5	.....	.....
Virginia City†	57c	− 4c	29.6c	1.77	15.5
Wibaux	64	−20	26.0	0.25	2.5
Yale†	67	−19	25.4	1.88	18.5
Nebraska.					
Agee *1	69	− 6	31.4	0.22	2.2
Albion	77	−12	33.6	0.58	
Alliance	.....	.....	.....	0.64	6.5
Ansley†	83	− 9	34.4	0.35	2.0
Arapaho *1	72	− 2	35.5	1.17	4.5
Arborville *1	71	−10	35.4	0.65	2.5
Ashland *a*†	73	− 4	36.6	0.25	1.0
Ashland *b*†1	70	1	34.7	.....	.....
Ashton	79	− 8	33.2	0.32	1.0
Auburn *†1	79	− 2	37.4	0.18	T.
Aurora *1	78	0	34.9	0.20	2.0
Beatrice†	72	0	37.4	0.30	
Beaver City†	80	− 7	38.9	0.39	1.5
Benedict	.....	.....	.....	0.20	1.5
Benkelman	.....	.....	.....	0.15	T.

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Blair				0.12	
Bluehill *1	72	2	36.5	0.68	0.8
Brokenbow				0.40	4.0
Burchard				0.05	
Burwell				0.20	2.0
Callaway †	72	— 2	36.1	0.30	1.0
Camp Clarke	79	— 6	36.0	0.72	7.2
Central City				0.70	2.0
Chester *1	70	0	36.8	0.75	T.
Columbus †	70	— 8	34.3	0.15	1.0
Cornlea				0.27	
Creighton †	76	—12	31.5	0.30	T.
Crete	72	— 3	37.6	0.35	0.3
Culbertson				0.38	0.5
Curtis *a*	79	0	39.5	1.60	1.0
Dannebrog				0.28	0.8
David City *†	68	— 8	33.6	0.30	2.0
Dawson	80	2	41.1	0.30	
Divide				0.34	0.5
Dunning *1	67	0	35.5	0.40	4.0
Eden				0.17	
Edgar *1	68	0	36.3	0.40	T.
Elba				0.05	0.5
Ericson *†1	55	—15	31.7	0.10	1.0
Ewing †				0.05	0.5
Fairbury †	75	1	37.2	0.36	T.
Fairmont †	72	— 6	35.2	0.33	0.5
Fort Robinson	77	— 8	32.1	0.65	6.5
Franklin	81	— 2	38.6	0.44	1.0
Fremont †	72	—12	34.4	0.22	2.0
Geneva †	72	— 3	36.4	0.45	1.0
Genoa	70	— 7	34.2	0.34	2.2
Gering †	72	— 9	36.9	0.68	6.8
Gothenburg	80	— 3	35.2	0.70	2.0
Grand Island *a* *1	80	2	38.7	0.75	3.0
Grand Island *b*	70	— 3	35.0	0.65	1.5
Greeley	55	3	32.4	0.10	1.0
Haigler *1	60	3	35.1	0.40	
Hartington †	77	— 9	32.4	0.91	4.5
Harvard *1	70	— 5	32.0	0.57	1.0
Hastings *1	72	0	33.4	0.60	2.0
Hayes Center				0.30	T.
Hay Springs	72	— 9	32.2	1.60	15.5
Hebron †	73	0	36.9	0.45	T.
Hickman				0.03	T.
Holdrege *b* *1	65	2	33.6	0.27	0.7
Imperial †	78	— 4	37.4	0.52	4.2
Indianola (near)				0.30	0.8
Kearney *5	78	1	40.1	0.82	0.2
Kennedy	78	—11	33.4	1.74	17.0
Kimball †	75	3	38.4	0.60	6.0
Kirkwood *1	70	— 6	30.6	0.52	4.5
Lexington †	75	— 3	34.0	0.72	
Lincoln *b* †	71	1	37.7	0.12	1.0
Lincoln *d*	74	0	38.0	0.25	T.
Lodgepole †	84 *c*	— 6 *c*	36.2 *c*	0.20 *c*	2.0
Loup *b* *1	80	— 6	34.8	0.25	T.
Lynch *†1	76	—15	30.5	0.57	4.5
Lyons				0.25	2.5
McCook *1	67	0	36.6	0.55	3.0
Madison *1	68	— 9	30.4	0.35	2.0
Madrid *5	78	5	36.4	T.	T.
Marquette				0.75	2.5
Minden *a*	73	— 8	34.6	0.97	2.2
Minden *b*				0.84	
Monroe				0.17	
Nebraska City *c*	75	0	38.5	0.05	
Nemaha *1	72	— 2	33.7	0.50	
Nesbit	77	— 6	34.5	0.80	6.0
Norfolk *a* †	70	— 6	33.8	0.26	0.5
Norfolk *b*	74	—14	33.2	0.23	0.5
Norman				0.89	2.0
Oakdale †	78	—12	31.2	0.64	1.2
Odell *5	68	— 1	37.2	0.15	
O'Neill †	77	—13	31.5	0.13	2.0
Ord	75	—12	34.5	0.10	
Osceola				0.37	3.5
Ough †				0.33	0.3
Palmer *b*				0.08	T.
Ravenna *a*	82	— 5	35.6	0.30	0.8
Redcloud *a*				0.60	0.2
Redcloud *b* *1	70	2	40.4		
Republican *1	72	0	35.5	0.30	0.5
Rulo *1	80	6	41.4	0.30	
St. Libory	72	— 5	36.0	0.23	0.5
St. Paul	71	— 3	37.0	0.17	1.0
Salem		6		0.15	
Santee Agency †	75	— 8	33.2	0.52	5.2
Sargent				0.12	1.0
Schuyler				0.20	2.0
Seneca *1	62	0	35.0	0.52	T.
Seward *1	72	0	36.2	0.30	3.0
Springview	72	—11	31.5	0.30	3.0
Stanton *1	76	—11	32.2	0.39	2.0
Strang *1	70	2	35.6	0.25	T.
Stratton				0.24	
Stromsburg				0.30	
Superior *5	70	0	35.6	0.75	T.
Sutton	69	— 5	33.0	0.47	2.8
Syracuse				0.05	0.5
Tecumseh *b* †				0.18	
Tekamah	73	— 9	34.2	0.32	3.0
Thedford *1	72	—10	32.9	0.45	2.5
Turlington †	70	— 6	32.4	0.11	T.
Valentine †	78	—16	32.8	0.93	9.0
Valparaiso				0.51	2.5
Wakefield	73	— 9	33.2	0.59	4.5
Wallace *1	71	8	34.9	0.50	
Weeping Water *1	76	— 7	33.4	0.21	0.8
Westpoint †	68	— 8	35.4	0.20	2.0
Whitman				1.00	10.0
Wilber *1	70	8	39.2	T.	T.
Willard				0.95	T.
Wilsonville *1	74	— 7	35.4	0.55	3.0
Wisner				0.23	2.0
Woodlawn				0.19	
York *1	70	0	33.3	0.60	1.0
Nevada.					
Austin	61	10	39.5	0.55	4.0
Battle Mountain *1	60	18	37.3	0.45	
Beowawe *1	72	15	38.9	0.18	2.0
Blaine				0.99	
Candelaria	77	19	46.8	T.	
Carlin *1	66	8	38.2	0.50	5.0
Carson City	73	14	42.1	0.88	1.4
Clover Valley				1.50	
Cranes Ranch				0.75	0.5
Elko *5	70	10	41.2	1.08	2.0
Elko (near)	69	— 2	33.8	1.37	4.0
Ely	62	0	34.8	1.85	11.5
Empire Ranch	60	— 6	36.7	0.42	3.5
Fenelon *1	52	10	31.8	0.77	3.0
Golconda *1	68	30	34.8	0.10	
Halleck *1	68	8	37.7	1.13	1.0
Hawthorne *a* *5	69	29	46.5	0.00	
Hawthorne *b*	74	19	46.6	0.13	0.2
Hot Springs *1	65	13	43.8	0.00	
Humboldt *1	68	14	43.2	0.13	
Keysers Springs				0.30	
Lewers Ranch	71	15	43.8	3.66	5.0
Los Vegas	68	23	46.0	0.00	
Lovelock *1	66	12	41.9	0.09	0.8
McGill	66	— 2	36.3	1.32	14.0
Martins	74	12	42.8	0.89	4.0
Midas	65	16	41.8	0.51	8.0
Mill City *1	68	10	38.3	0.00	
Monitor Mill	63	2	35.0	0.79	10.2
Osceola	68	12	42.4	1.44	16.0
Palisade *5	65	12	41.3	0.80	2.0
Palmetto	70	5	39.7	T.	T.
Reno *5	70	17	40.2		
Reno State University	71	15	41.9	0.16	T.
Ruby Valley				0.71	2.6
St. Clair	68	12	41.6	0.05	
San Antonio	65	11	41.9	0.12	T.
Silver Peak	74	14	44.2	T.	
Tecoma *1	60	12	36.9	0.12	1.0
Toano *1	62	16	36.6	0.83	2.0
Tybo	60	20	42.2	0.90	7.0
Verdi *1	68	16	40.7	1.62	2.5
Wadsworth *1	76	12	40.1	0.29	1.0
Wells	62	6	35.8	1.12	
New Hampshire.					
Concord	62	— 1	34.6	6.59	10.5
Durham	64	9	36.2	6.79	5.5
Grafton †	64	3	32.9	5.07	10.0
Hanover	59	4	33.0	5.78	7.8
Keene	60	0	34.4	6.04	8.0
Lancaster	60	4	31.0	5.75	9.8
Nashua	65	6	35.9	6.60	10.2
Newton	64	7	36.7	6.96	2.0
North Conway	61	4	32.8	5.00	4.5
Peterboro	65	1	34.1	6.12	13.4
Plymouth	60	7	32.8	5.17	5.0
Sanbornton †	59	2	32.2	5.65	14.0
Stratford	67	4	33.2	5.75	9.0
Warner				6.73	5.5
West Milan	57	2	30.6	5.51	9.0
New Jersey.					
Asbury Park	71	16	45.7	3.75	1.2
Barnegat	70	23	48.2	4.69	T.
Bayonne	70	20	45.0	4.52	2.3
Belvidere	67	14	41.3	5.95	3.0
Beverly †	74	18	44.6	4.32	1.0
Billingsport *1	69	26	44.6	4.71	
Boonton	69	15	41.2	5.91	2.0
Bridgeton	70	25	47.0	4.19	T.
Camden	69	24	45.0	3.79	1.0
Cape May C. H. †	72	19	48.2	3.40	
Charlotteburg	68	14	41.2	5.20	3.0
Chester	66	11	39.2	5.85	2.0
Clayton	72	18	45.0	4.85	T.
College Farm †	70	17	44.6	4.52	2.0
Deckertown	68	12	41.4	5.18	3.0
Dover	70	12	40.4	5.79	2.7
Egg Harbor City	71	17	45.1	4.26	T.
Elizabeth †	66	19	43.6	5.03	T.
Englewood	68	16	42.0	4.94	T.
Franklin Furnace	62	10	39.6	3.95	1.5
Freehold	69	16	44.2	4.87	2.0
Friesburg				4.94	T.
Gillette	70	16	42.2	4.14	2.0
Hammonton				3.85	
Hanover	65	16	42.2	5.10	2.0
Hightstown	70	19	44.8	5.41	0.2
Imlaystown	67	20	44.1	3.99	0.8
Lambertville	67	19	43.6	4.68	2.0
Moorestown	72	19	45.0	4.64	2.0
Newark *b* †	68	21	43.9	4.99	2.2
New Brunswick *a*	68	18	44.7	4.69	1.5
New Brunswick *b*	68	18	43.7	4.94	1.5
Newton	66	14	40.7	5.11	3.0
Ocean City	63	20	47.2	3.94	
Oceanic	73	22	46.5	4.24	0.5
Paterson	69	19	44.8	4.88	2.0
Perth Amboy	70	18	43.7	5.14	2.5
Plainfield	67	15	42.4	5.07	2.0
Port Norris	66	20	46.7	2.97	0.5
Rancocas				4.06	2.0
Rivervale	66	13	41.6	5.43	2.0
Roseland	68	12	42.0	5.54	2.8
Sergeantsville	68	18	43.2	4.92	2.0
Somerville	69	11	43.0	4.98	2.0
South Orange	66	18	42.0	4.62	1.0
Staffordville				3.87	T.
Toms River	75	15	45.2	4.26	0.2
Trenton	70	22	47.4	3.94	T.
Vineland	73	16	46.3	4.26	T.
Woodbine	69	15	43.4	2.89	
New Mexico.					
Albert	76°	17°	49.0°	0.00	
Albuquerque †	65	20	44.7	T.	
Alma	74	15	46.2	T.	
Angus V. V. Ranch	69	13	42.4	0.78	
Aztec †	67	9	38.4	0.05	
Bernalillo †	70	18	44.8	0.10	
Bluewater	65	6	38.0	T.	
Buckmans	58	— 5	30.4	0.03	0.3
Clayton	83	14	47.2	0.00	
Deming *5	78	28	51.5	0.00	
East Lasvegas †	71	12	43.6	0.00	
Eddy	80	13	51.0	T.	
Engle †	71	19	43.4	0.00	
Fort Bayard	78	22	49.0	0.00	
Fort Union	75	20	48.2	0.00	
Fort Wingate	73	10	40.0	0.40	
Galisteo †	70	17	42.2	0.00	
Gallinas Spring †	75	15	47.4	0.00	
Gila	75	24	49.8	T.	
Hillsboro	72	18	47.4	0.01	
Las Cruces †	82	20	50.1	T.	
Lordsburg *5	77	29	52.7	0.00	
Los Lunas	70	12	41.0	T.	
Lower Penasco	78	22	49.6	0.10	
Raton	72	11	45.2	0.00	
Rincon †	82	22	51.0	0.00	
Roswell †	87	14	48.9	T.	
Shattucks Ranch	78	19	52.9	T.	T.
White Oaks †	69	24	46.2	0.06	
Winsors Ranch	66	7	35.6	0.20	2.0
New York.					
Adams				2.73	
Addison	64	14	40.3	3.10	1.5
Akron				5.09	
Angelica †	63	18	38.7	3.07	4.0
Appleton	66	18	40.3	4.40	3.3
Arcade	63	14	36.9	4.35	9.9
Arkwright	59	17	38.2		
Atlanta				2.81	
Auburn	68	15	39.1	4.49	6.0
Avon	67	12	40.4	2.19	T.
Baldwinsville	64	13	38.4	5.05	
Bedford	70	11	42.0	5.30	3.8
Big Sandy *10	63	12	37.3		
Binghamton †	64	7	38.1	2.89	3.7
Bolivar	64	15	38.0	4.69	9.5
Bouckville	62	— 2	35.4	4.34	1.8
Boyds Corners				6.31	
Brentwood	65	9	42.6	4.90	2.0
Brooklyn	67	21	44.5	3.66	1.5
Canajoharie	60	15	37.6	4.03	6.0
Canton	59	5	32.6	5.38	1.0
Carmel	64	10	39.4	6.22	2.5
Catskill	62	11	39.6	7.57	6.0
Cedar Hill				5.00	7.0
Charlotte *10	60	19	37.0		
Chenango Forks				2.90	
Cherry Creek				6.41	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean	Rain and melted snow.	Total depth of snow.
New York—Cont'd.	°	°	°	*Ins.*	*Ins.*
Cooperstown†	60	8	35.2	5.21	8.0
Cortland	64	14	38.2	3.55	
Dekalb Junction				4.72	
Dryden	61	9	37.8		
Eagle Mills				4.58	
Easton				5.74	
Elmira	67	15	40.6	2.89	
Fayetteville				5.02	
Fleming	65	15	39.0	2.68	T.
Fort Niagara†	67	19	41.5	3.69	1.0
Franklinville	65	15	37.6	5.00	11.6
Fulton				7.87	
Garrattsville	61	5	35.8	5.23	4.0
Glens Falls	60	3	34.1	10.02	6.6
Gloversville	62	6	34.5	6.79	8.9
Greenwich	61	0	36.6	5.79	6.0
Haskinsville				2.90	
Honeymead Brook	62	5	37.9	5.07	4.2
Humphrey†	65	15	37.1	4.83	14.8
Ithaca	63	14	39.4	4.22	1.5
Jamestown	63[f]	18[f]	39.2[f]	6.52	19.5
Kings Station				8.15	
Lake George	59	4	36.0	6.95	9.5
Little Falls	63	12	34.2	4.80	11.5
Lockport	65	21	39.0	4.46	5.0
Lowville	63	— 2	34.1	5.81	12.0
Lyons	63	20	40.6	3.46	6.0
Madison Barracks†	67	9	36.3	2.66	7.5
Middletown	62	15	40.0	5.05	
Mohonk Lake	63	15	39.4	5.10	6.0
Mount Morris				2.20	T.
Napoli				4.95	
Newark Valley				3.82	
New Lisbon	62	— 1	34.3	4.04	9.2
Niagara Falls				5.19	
North Hammond†	66	10	36.2	4.01	4.0
North Lake	59	— 4	31.0	10.24	13.0
Number Four†	59	— 3	31.3	6.45	9.8
Ogdensburg	58	10	34.2	4.01	0.2
Oneonta	64	9	38.0	5.03	
Oxford	62	2	36.0	4.85	8.5
Palermo	64	17	36.7	8.17	42.8
Penn Yan	65	16	40.1	2.61	5.0
Perry City	68	12	37.4	3.74	3.0
Phœnix				6.26	
Pine City				3.53	
Pittsford	65	19	39.6	3.54	
Plattsburg Barracks†	57	8	33.0	3.58	
Port Jervis	62	13	39.5	5.91	3.0
Poughkeepsie	65	5	39.2	5.45	2.0
Primrose	65	17	42.2	4.89	3.0
Ridgeway	66	20	40.1	5.02	4.0
Rome	57	10	34.0	6.25	
Romulus	64	17	40.0	4.06	4.1
Rose				4.95	
St. Johnsville	60	3	35.4	3.04	5.0
Saranac Lake	62	0	30.1	4.74	6.5
Schenevus				5.58	
Scottsville				3.86	
Setauket†	65	21	43.3	5.76	2.0
Sherwood				3.10	
Skaneateles				5.70	
South Canisteo	65	14	37.9	3.56	6.8
Southeast Reservoir				5.72	
South Kortright†	61	3	35.4	4.35	
Straits Corners	65	9	37.3	3.90	4.2
Ticonderoga	61	4	37.4	5.66	1.0
Victor	66	16	38.6	2.79	5.7
Wappingers Falls	68	11	40.0	7.24	5.5
Warwick				4.07	
Watkins	67	17	40.1	2.81	3.4
Waverly†	67	7	39.4	3.69	2.8
Wedgwood	64	13	36.9	3.20	2.5
Westfield	65	20	42.0	4.60	2.0
Westpoint†	63	18	39.8	5.40	
Willetspoint	67	21	44.0	4.66	1.0
North Carolina.					
Abshers	80	16	48.3	2.82	
Asheville†	77	20	46.7	1.37	
Beaufort†	74	34	58.4	1.38	
Biltmore†	77	16	46.1	1.02	T.
Bryson City†				1.43	
Chapelhill†	78	20	51.2	3.77	
Edenton	74	29	53.0	2.71	
Experimental Farm	74	26	52.4	2.69	
Fairbluff†				1.77	
Fayetteville†	78	24	53.0	3.43	
Flatrock	72	19	45.2	4.65	
Greensboro†	74	24	50.4	3.63	
Greenville	78	27	54.3	5.71	
Henderson†	74	24	51.6	3.34	
Highlands	66	18	44.8	5.67	
Horse Cove	70	21	47.5	4.80	
Jacksonville	77	28	55.3	1.65	
Lenoir*†	70	22	46.0	2.43	
Linville†	64	12	41.1	2.24	
North Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Littleton†	75	21	50.0	2.51	
Louisburg†	76	23	50.2	3.05	
Lumberton†	74	28	53.4	1.90	
Lynn†	72	23	49.8	5.23	
Mana				3.45	
Marion	77	20	48.8	2.90	
Mocksville				3.67	
Moncure†	77	25	51.8	3.68	
Monroe†	75	24	51.4	2.40	
Morganton	74	21	49.1	2.13	
Mount Pleasant	76	25	50.7	3.31	
Murphy†				1.96	
Newbern†	79	37	60.4	1.33	
Oakridge†	74	22	48.8	3.91	
Pantego				1.32	
Pittsboro†	73	25	50.2	3.28	
Rockingham†	77	28	53.0	0.82	
Roxboro†	76	17	49.2	2.82	
Salem†	73	19	48.2	4.41	
Salisbury†	78	24	51.8	3.85	
Saxon†	76	15	48.4	4.43	
Selma	78	26	54.2	3.25	
Settle	72	24	48.6	3.24	
Sloan†	78	25	55.2	1.96	
Soapstone Mount†	76	18	49.8	3.99	
Southern Pines *a*†	77	25	54.6	3.25	
Southern Pines *b*	78	29	54.9	3.45	
Southport†	76	32	58.3	1.93	
Springhope*[1]	75	25	50.0	3.00	
Tarboro	79	22	51.8	2.99	
Wash Woods				1.34	
Waynesville†	71	15	45.7	1.33	
Weldon†	77	24	51.4	3.21	
Willeyton	77	25	52.2	2.97	
North Dakota.					
Ashley†	79[b]	—18[b]	34.1[c]	T.	T.
Bottineau	56	—28	13.0	0.42	3.5
Buxton	60	—15	20.8	0.15	1.5
Churchs Ferry	60	—16	18.8	0.30	3.0
Coalharbor†	79	—20	21.2	0.50	5.0
Devils Lake†		—15		0.30	3.0
Dickinson	69	—14	24.8	0.85	8.5
Dunseith	58	—23	15.6	T.	T.
Ellendale	72	—13	24.3	T.	T.
Falconer	72	—24	21.2	0.14	1.4
Fargo†[6]	52*	—16	21.4	0.25	2.2
Forman†	64	—15	23.6	0.04	0.5
Fort Berthold	86	—24	30.9	0.12	1.2
Fort Yates†	77	—19	22.6	0.72	7.2
Gallatin†	67	—19	19.3	0.31	3.0
Glenullin	72	—19	21.0	T.	T.
Goetz	64	—25	18.4	0.33	1.5
Grafton†	56	—15	17.9	0.40	4.0
Grand Rapids†	70	—13	23.2	0.21	2.0
Hamilton	58	—18	16.5	1.07	4.5
Jamestown†	72	—13	23.4	0.20	2.0
Kelso	68[f]	—17[f]	22.2[f]		
Larimore†	63	—12	19.4	0.10	1.0
McKinney	65	—22	14.2	0.64	1.5
Mayville		—11		0.32	2.0
Medora†	69	—20	22.6	0.41	4.2
Milton†	58	—19	14.2	0.40	4.0
Minnewaukon	58	—17	18.8	0.20	2.0
Minto†	56	—16	18.0	0.55	
Napoleon†	70	—15	22.8	0.23	2.3
New England City	64	—20	21.2	0.30	3.0
Oakdale†	69[c]	—13[c]	23.4[c]	0.87	8.2
Portal	63	—26	14.4	0.20	2.0
Power†	71	—17	24.4	0.10	1.0
St. John†	53	—20	15.2	0.60	6.0
Sheyenne	75	—18	21.0	0.60	6.0
Steele†	66	—19	22.4	0.50	5.0
Towner†	60	—20	18.5		
University	57	—13	21.8	0.29	1.5
Valley City†	61	—12	17.2	0.22	2.2
Wahpeton†	64	—10	27.0	0.27	1.0
White Earth	64	—22	19.2	0.30	3.0
Whites Ranch	70	—21	24.4	0.40	4.0
Wildrice†[2]			20.0	0.40	4.0
Woodbridge†	60	—25	16.9	0.08	0.8
Ohio.					
Akron	64	15	41.4		T.
Annapolis	70	15	42.8	5.42	T.
Ashland	62	14	37.8	5.25	T.
Ashtabula	62	20	41.8	5.11	1.0
Atwater				4.96	T.
Bangorville	67	9	40.1	7.33	T.
Bellefontaine	64	11	45.0	6.43	
Bement				7.80	2.0
Benton Ridge	66	13	40.2	6.60	T.
Bethany	68	17	45.4	8.53	
Bigprairie	64	12	39.5	5.97	T.
Binola				5.69	1.0
Bissells	59	16	40.5	6.90	4.4
Bloomingburg	68	13	43.6	7.72	T.
Bowling Green	65	13	40.4	6.68	T.
Ohio—Cont'd.	°	°	°	*Ins.*	*Ins.*
Cambridge	66	10	41.2	7.14	
Camp Dennison	68	16	45.0	6.32	
Canal Dover	65	10	40.6	7.88	T.
Canton†	70	15	41.8	5.70	T.
Cardington	65	15	40.8	5.79	T.
Carrollton	67	11	41.2	6.50	T.
Cedarville	66	22	47.7	8.90	T.
Celina	65	11	41.9	6.34	T.
Cherryfork	67	10	42.8	6.74	
Chillicothe	68	18	44.8	6.00	T.
Circleville	69	16	44.6	7.05	
Clarksville	67	14	44.5	6.95	T.
Cleveland *a*	64	19	42.3	5.71	0.4
Cleveland *b*	67	18	41.2	4.76	T.
Coalton	70	13	44.0	6.47	T.
Colebrook	64	17	40.5	6.77	1.5
Dayton *a*	70	14	44.2	8.40	
Dayton *b*†				7.51	
Defiance	66	10	39.4	5.70	T.
Delaware	64	13	41.6	6.69	T.
Demos	72	12	42.4	6.32	T.
Dupont	64	12	41.2	3.84	T.
Elyria	67	17	41.4	6.89	0.1
Fairport Harbor*[10]	66	24	44.7		
Fayetteville	65	12	43.8	6.57	T.
Findlay	67	13	41.7	5.41	T.
Frankfort	74	13	43.8	6.30	
Garrettsville†	68	14	40.2	6.20	5.5
Granville	66	12	41.2	7.98	T.
Gratiot	64	14	41.8	6.80	1.0
Greenfield	65	18	44.4	5.60	T.
Greenhill	69	14	39.9	5.85	T.
Greenville	61	13	41.6	8.02	
Hackney	69	22	46.9	7.94	
Hanging Rock	74	14	47.0	5.51	
Hillhouse	67	15	39.8	6.41	2.0
Hillsboro†	71	12	44.0	6.69	T.
Hiram	65	14	39.1	6.15	7.5
Hudson	65	15	39.8	7.11	5.0
Jacksonboro	69	15	42.0	8.00	T.
Kenton†	68	11	41.9	7.50	T.
Killbuck	69			6.64	T.
Lancaster	66	15	43.0	6.88	
Leipsic	62	9	39.6	6.52	T.
Levering	64	8	38.0	8.29	T.
Logan	72	13	44.0	6.68	
Lordstown	68	17	40.4	4.71	0.5
McArthur	68	9	42.1	5.81	T.
McConnelsville†	71	12	43.5	7.24	T.
Mansfield†				6.46	
Marietta *b*	70	19	45.4	5.39	
Marion	67	10	41.6	5.73	T.
Medina	68	15	41.5	5.99	T.
Milfordton	67	10	38.1	6.48	T.
Milligan	70	11	42.2	6.99	T.
Millport	74	12	39.7	6.20	0.2
Montpelier	63	13	38.4	4.06	T.
Napoleon	63	10	38.8	4.57	
Neapolis				5.65	
New Alexandria	64	14	41.9	7.46	T.
New Berlin	65	12	40.2	5.82	T.
New Bremen	65	11	42.2	5.32	
New Comerstown	65	15	41.8	6.96	T.
New Holland	67	15	42.4	5.53	T.
New Moscow				7.79	T.
New Paris	67	12	41.5	10.18	T.
New Waterford	65	15	41.0	5.72	0.2
North Lewisburg	65	12	41.6	8.20	
North Royalton	67	15	40.5	5.28	1.0
Norwalk	67	14	41.6	6.57	T.
Oberlin	67	18	42.0	7.89	T.
Ohio State University	65	14	42.0	7.29	
Orangeville	64	17	39.6	5.61	3.0
Ottawa	65	13	42.4	5.61	T.
Pataskala†	66	12	42.0	8.29	T.
Perry				5.99	
Philo	66	12	42.0	7.29	T.
Plattsburg	65	12	42.4	7.74	T.
Point Marblehead*[10]	62	20	44.8		
Pomeroy	72	13	44.7	4.54	T.
Portsmouth *a*†				6.92	
Portsmouth *b*	76	18	47.2	6.74	
Richwood	62	9	41.4	7.02	T.
Ridgeville Corners	64	9	39.2	5.55	T.
Ripley	69	16	45.6	6.68	
Rittman	63	12	44.8	6.85	T.
Rockyridge	64	12	40.2	6.78	T.
Rosewood	64	12	41.6	8.19	T.
Shenandoah	65	11	39.3	5.84	T.
Sidney *b*	65	14	41.2	7.54	0.5
Sinking Spring†	67	16	44.6	6.75	T.
Somerset†	74			4.96	T.
Springboro				9.34	T.
Spring Valley	65	14	41.8	9.76	
Strongsville				7.02	
Sylvania	63	11	37.8	5.31	1.0

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Ohio—Cont'd	°	°	°	*Ins.*	*Ins.*
Thurman	76	13	45.1	4.82	
Tiffin†	63	15	41.6	5.91	0.1
Upper Sandusky	65	14	41.8	6.21	T.
Urbana	63	14	41.6	6.06	
Vanceburg	70	18	49.1	7.20	
Van Wert	67	10	39.8	5.65	T.
Vermillion	65	18	40.8	7.05	T.
Vickery	65	14	41.0	5.76	T.
Walnut				6.06	T.
Warren	69	19	40.8	5.73	6.6
Warsaw	67	10	41.0	6.47	T.
Wauseon	65	12	39.8	5.20	0.4
Waverly	71	13	44.6	6.49	T.
Waynesville	64	12	41.8	8.88	
Wellington	68	14	42.6	6.87	
Westerville	66	16	43.1	7.16	
Willoughby				5.06	
Wooster *b*†	65	12	41.2	5.76	0.5
Youngstown	67	16	39.7	4.84	1.0
Zanesville†				6.40	
Oklahoma.					
Anadarko†	82	14	51.6	0.25	
Arapaho†	82	7	47.8	0.18	
Burnett†	80	15	50.6	1.61	
Clifton†	82	12	48.7	0.77	
Edmond	78	10	47.6	0.70	
Fort Reno†	80	10	50.2	0.37	
Fort Sill	82	16	51.8	0.49	
Guthrie	79	12	50.0	0.33	
Hennessey	79			T.	
Jefferson†	85	11	50.6	0.00	
Kingfisher	84	11	49.8	0.14	
Mangum†	87	14	50.0	0.36	
Newkirk	81	8	47.4	T.	
Norman†	82	13	50.7	0.55	
Prudence†	76	9	46.0	T.	
Sac and Fox Agency†	88	12	48.6	0.70	
Stillwater†	82	8	47.0	0.80	
Oregon.					
Albany *a*	66	28	45.8	12.07	T.
Arlington	76	22	43.3	1.39	
Ashland *b*	74	22	42.7	2.48	
Aurora *e*†	65	30	43.8	13.29	2.0
Aurora (near)	66	28	44.1	11.14	3.2
Bandon	62	32	46.6	15.98	
Bay City†	62	32	45.4	28.00	
Beulah	70	9	35.9	1.09	1.5
Brownsville *e*†	64	28	48.6	8.29	
Burns	71	2	31.4		
Burns (near)	70	14	41.8	1.42	2.0
Canyon City	71	7	38.0	2.64	10.5
Cascade Locks	68	26	43.1	19.24	3.0
Comstock *e*§	68	32	47.1	9.06	
Corvallis	65	28	45.6	11.66	T.
Dayville†	74	9	40.2	2.63	1.0
Eugene	69	29	46.2	7.45	
Fairview	66	31	46.8	15.21	
Falls City	61	29	44.0	20.54	
Fife†	65	9	36.8	2.15	8.0
Forest Grove	63	28	42.4	13.74	
Gardiner	63	34	47.4	18.84	
Glenora	62	29	42.6	32.91	4.0
Government Camp	56	12	33.4	18.76	53.0
Grants Pass *a*†	71	28	44.4	4.51	
Happy Valley	73	9	37.8	1.78	5.5
Heppner	73	12	40.1	3.86	7.5
Hood River (near)	69	21	41.6	10.64	10.0
Irvington				10.86	
Jacksonville	71	22	43.0	3.62	T.
Joseph	63	11	33.4	2.04	15.0
Junction City *e*§	66	30	48.7	10.07	
Lafayette *e*§	65	32	46.9	12.58	
Lakeview†	65	10	36.6	1.78	7.5
Langlois	68	30	50.2	20.90	
Lorella	75	8	40.1	3.15	6.0
McMinnville	61	27	43.6	15.38	5.0
Merlin *e*§	68	26	41.9	4.17	
Monmouth *e*§	68	31	46.5	10.16	1.0
Monroe	64	28	45.7	16.61	T.
Mount Angel†	67	28	45.1	12.88	1.5
Nehalem				29.33	
Newberg	63[d]	27[d]	43.8[d]	13.87	
Newbridge	70	16	37.4	1.07	2.0
Newport	61	27	46.7	17.76	
Pendleton	76	14	41.8	4.24	9.2
Prineville	82	12	47.6	0.92	T.
Riddles *e*§	70	30	45.6	4.45	
Salem *b*†	65	31	45.8	11.67	3.0
Sheridan *e*§	62	33	46.8	11.73	4.0
Silver Lake	72	9	35.2	0.13	T.
Silverton *e*§	64	30	47.1	13.75	1.0
Siskiyou *e*§	62	27	40.4	2.45	11.5
Sparta	61	16	34.2	2.34	18.2
Springfield *e*§	65	30	45.7	7.52	
Stafford	65	25	43.3	14.62	8.0
The Dalles†	72	22	43.6	3.84	4.5
Oregon—Cont'd.					
Toledo	70	25	45.8	21.68	
Umatilla				2.64	3.0
Vale	71	9	36.3	0.55	
Vernonia	62	29	41.7	14.18	6.0
West Fork *e*§	66	32	45.7	7.66	
Weston	70	5	39.0	5.16	14.8
Williams	67	24	43.2	5.27	1.0
Pennsylvania.					
Altoona	68	24	46.3	4.31	T.
Aqueduct	69	20	44.4	5.87	2.4
Beaver Dam				6.18	T.
Bethlehem				5.99	3.5
Brookville†				5.36	3.2
Browers Lock				5.23	
Cameron				4.25	
Canonsburg	76	18	46.1	3.89	T.
Carlisle	67	21	42.4	4.07	1.0
Cassandra	61	19	40.2	4.88	5.0
Cedarrun				3.55	2.0
Centerhall†	62	20	40.6	5.43	4.0
Chambersburg†	66	18	41.4	5.28	
Coatesville	73	21	43.5	5.83	1.5
Confluence†	69	13	40.0	5.89	1.0
Coopersburg	72	20	44.8	6.80	2.1
Davis Island Dam†				5.42	T.
Derry Station	69	18	44.0	5.76	0.2
Doylestown				4.95	
Drifton				4.36	T.
Duncannon				4.77	2.0
Dushore	65	14	38.0	3.74	1.5
Dyberry	66	2	36.4	5.36	5.3
East Bloomsburg				3.98	0.5
East Mauch Chunk	70	12	40.7	6.59	3.0
Easton	64	17	42.2	6.20	2.5
Edinboro *e*[1]	60	16	37.9		
Ellwood Junction†				4.94	
Emporium	65	18	40.6	5.13	4.1
Everett	67	17	41.0	4.58	T.
Farrandsville				5.75	3.5
Forks of Neshaminy *e*[1]	64	26	44.8	5.12	2.0
Franklin	68	19	42.0	5.45	2.2
Frederick				5.78	
Freeport†				6.42	T.
Girardville				6.12	3.5
Grampian	66	16	38.4	6.04	6.0
Greensboro†	70	15	42.3	5.36	T.
Greenville	65	20	40.2	5.89	0.8
Hallstead†	64	7	38.6	3.41	T.
Hamburg	67	20	44.0	7.04	
Hawley	69	15	42.8	4.32	5.3
Hollidaysburg	70	18	42.0	4.95	T.
Huntingdon *a*†	70[c]	24[c]	42.0[c]	5.16	0.8
Huntingdon *b*				5.47	0.8
Indiana	72	16	44.6	6.32	0.5
Irwin				4.95	T.
Johnstown†	68	19	42.6	6.14	T.
Karthaus				2.51	5.0
Keating				4.78	0.3
Kennett Square	71	20	44.6	5.47	0.5
Lansdale				5.62	
Lawrenceville	61	13	39.0	3.47	3.0
Lebanon	67	22	42.7	5.76	2.1
Leroy†	65	13	37.0	3.81	3.6
Lewisburg	69	20	41.5	4.76	3.5
Lock Haven *a*†	70	18	42.8	5.89	8.0
Lock Haven *b*				4.93	3.0
Lock No. 4†				5.95	
Lycippus	70	15	43.2	5.41	1.8
Mahoning				2.10	
Mifflin				3.60	1.0
Oil City†				6.37	5.8
Ottsville				4.80	
Parker†				5.39	0.6
Philadelphia *b*	70	24	46.2	4.84	1.0
Point Pleasant				4.70	
Pottstown	70	22	44.3	6.48	1.5
Quakertown	68	13	41.4	5.58	1.0
Reading[2]			42.4	5.43	T.
Reedsville	64	20	41.9	2.37	T.
Renovo *b*	66	21	41.6	4.82	3.2
Ridgway†				4.45	4.5
Saegerstown	69	17	39.5	6.51	8.0
St. Marys	63	15	38.7	4.99	1.4
Salem Corners	65	11	38.5	5.09	6.2
Scranton	65	10	40.2	4.14	3.0
Seisholtzville				6.99	
Selinsgrove	68	21	41.2	6.35	6.0
Shawmont				5.22	2.2
Shinglehouse	70	14	39.7	6.41	5.5
Sinnamahoning				3.19	
Smethport	67	18	38.1	5.93	6.5
Smiths Corners				5.03	
Somerset	68	12	40.0	5.86	2.9
South Bethlehem	72	22	44.6		
South Eaton	68	12	41.0	3.96	2.0
State College	63	20	40.0	5.26	2.3
Pennsylvania—Cont'd.					
Sunbury				3.45	3.0
Swarthmore	66	21	43.6	6.15	
Swiftwater	68	11	37.3	6.72	4.0
Towanda	67	15	40.3	2.80	3.0
Uniontown	67	17	42.2	6.24	T.
Warren†		21		6.60	5.0
Wellsboro†	67	18	39.6	5.21	3.8
West Chester	68	20	43.7	5.08	1.2
West Newton†				5.52	T.
Westtown	68	19	42.6	4.79	1.0
White Haven	66	8	38.3	4.94	4.0
Wilkesbarre†	66	16	41.6	4.35	3.0
Williamsport	66	23	42.2	3.46	4.2
York†	69	22	42.2	5.69	1.5
Rhode Island.					
Bristol	63	14	43.3	7.57	8.0
Kingston	68	5	40.5	10.25	9.0
Providence *a*	64	11	42.0	7.09	7.0
South Carolina.					
Anderson†				4.28	
Batesburg†	76	32	55.8	1.10	
Blackville†	82	33	57.1	1.09	
Camden†				2.11	
Central	77	26	51.8		
Cheraw *a*†	78	25	52.8	3.74	
Cheraw *b*†				4.14	
Clemson College	78	26	52.8	3.61	
Conway†				0.90	
Darlington (near)				0.72	
Edisto†				1.01	
Effingham†				2.87	
Florence†	78	31	54.4	2.56	
Gaffney†				5.05	
Georgetown†	80	35	57.0	1.00	
Gillisonville	85	30	58.9	0.26	
Greenville†	75	26	49.7	4.54	
Greenwood	74	31	54.6	2.34	
Holland	85	23	51.7	4.40	
Kingstree *a*†	79	30	55.4	2.20	
Kingstree *b*				2.24	
Little Mountain	81	29	56.0	2.00	
Longshore†	77	30	54.4	1.78	
Mount Carmel†				2.43	
Pinopolis *e*[1]	73	38	55.5	1.86	
Port Royal†	77	40	61.5	0.50	
St. Georges†	79	35	56.8	0.92	
St. Matthews†	83	33	56.8	0.99	
St. Stephens†				1.49	
Santuck†	74	25	52.2	2.32	
Shaws Fork *e*[1]	79	28	53.5	0.76	
Smiths Mills†				1.45	
Society Hill†	77	29	54.2	0.80	
Spartanburg	74	27	50.4	4.78	
Statesburg†	75	32	55.8	0.94	
Trenton	79[c]	33[c]	58.2[c]	1.58	
Trial†	88	32	60.6	2.47	
Walhalla	76	23	49.2	3.72	
Winnsboro	75	29	51.8	1.16	
Yemassee†	78	35	58.2	0.27	
Yorkville	76	28	53.4	2.79	
South Dakota.					
Aberdeen†	72	−13	27.0	0.30	T.
Alexandria†	70	−15	30.0	0.44	2.5
Ashcroft†	73	−23	24.4	1.06	12.5
Brookings†	70	−16	27.6	0.56	5.5
Canton	75	−15	26.8	0.19	2.0
Centerville				0.25	3.8
Chamberlain†	72	−16	30.2	0.38	4.0
Clark				1.30	7.0
Cross†	69	− 8	30.8	1.10	16.1
De Smet	67	−14	25.7	1.10	11.0
Doland	65	−26	25.8	0.53	7.0
Edgemont				1.80	18.0
Eureka	70	−23	22.2	0.05	0.5
Farmingdale				0.55	
Flandreau	78	−16	29.2	0.40	3.0
Forestburg†	71	−22	28.4	0.47	4.7
Forest City	71	−16	25.6	0.20	2.0
Fort Meade†	77	− 8	31.2	0.50	5.1
Gann Valley	67	−22	28.0	0.25	4.0
Gary	68	−12	23.6	0.55	4.0
Goudyville	71	−19	24.6	0.16	2.0
Greenwood				0.38	4.0
Highmore[4]	73	−16	26.4	0.48	4.0
Hotch City†	68	−21	27.4	0.53	5.2
Hot Springs	66	− 1	32.4	0.87	8.7
Howard†	70	−23	27.8	0.25	2.5
Interior	72	− 8	30.5	1.10	11.0
Ipswich	76	−15	25.8	0.33	T.
Kimball†	68	−13	29.4	0.81	7.5
Leslie†	88	−19	25.0	T.	T.
Mellette†	70	−17	24.8	0.30	3.0
Menno†	76	−16	33.2	0.37	3.0
Millbank	70	−15	29.2	0.25	2.5
Mitchell†	72	−11	31.0	0.11	1.5
Nowlin	79	−26	28.6	0.45	4.5

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
South Dakota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Oelrichs†	74	− 7	29.4	2.70	27.0
Parker†	73	−16	28.9	0.95	3.0
Parkston†	67	−14	29.4	0.20	1.0
Plankinton†	70	−15	27.2	0.35	5.0
Redfield	74	−14	28.0	0.18	3.0
Rochford	70	.....	.....	1.87	9.0
Shiloh	65	−15	25.9	T.	T.
Silver City	.....	.....	.....	1.87	18.5
Sioux Falls†	73	−13	29.8	0.44	2.5
Spearfish†	74	− 6	39.0	0.83	9.8
Tyndall†	72	− 7	33.4	0.48	4.0
Vermillion	78	−18	32.8	0.10	1.0
Watertown	66	−18	25.0	0.20	2.0
Wentworth†	76	−13	27.4	0.46	2.2
Wessington Springs	71	−14	26.8	0.60	6.0
Tennessee.					
Andersonville	75	21	48.4	2.06	
Arthur†	.....	.....	.....	1.74	
Ashwood*†	76	26	51.1	3.58	
Benton (near)†	.....	.....	.....	0.91	
Bluff City†	.....	.....	.....	1.42	
Bolivar†	76	23	49.7	4.05	
Bristol†	73	17	45.6	0.69	
Byrdstown	74	20	49.0	3.85	
Cagle	75	20	48.4	2.87	
Carthage†	.....	.....	.....	3.92	
Clarksville	76	22	50.2	3.06	
Charleston	.....	.....	.....	1.98	
Clinton†	.....	.....	.....	1.95	
Covington	77	25	51.6	3.77	
Decatur†	74	23	49.5	2.37	
Elizabethton†	77	18	48.4	1.72	
Elk Valley	74	20	49.8	2.70	
Erasmus	.....	.....	.....	3.02	
Fairmount*§	68[d]	25	47.0[e]	2.53	
Florence†	76	23	49.6	3.62	
Franklin	75	24	50.2	3.36	
Grace	.....	.....	.....	3.29	
Greeneville†	73	20	48.5	1.46	
Harriman	71	21	47.4	2.64	
Hickory Withe	75	24	52.2	6.90	
Hohenwald†	.....	.....	.....	5.03	
Jackson†	77	23	50.0	3.10	
Johnsonville†	77	20	50.6	3.43	
Jonesboro*‖	74	22	45.5	2.24	
Kingston†	.....	.....	.....	2.22	
Liberty†	76	24	51.0	3.38	
Lynnville†	75	24	50.2	4.41	
McKenzie†	77	22	50.6	4.06	
McMinnville†	73	24	48.8	3.05	
Molino†	75	23	51.0	3.16	
Newmarket	.....	.....	.....	1.64	
Newport†	74	20	48.6	1.40	
Nunnelly	76	20	49.8	3.74	
Oak Hill*‖	76	22	48.8	4.15	
Palmetto†	76	24	52.7	3.33	
Peryear	74	20	49.2	4.14	
Pope	78	23	51.1	4.28	
Riddleton†	76	23	50.0	3.57	
Rogersville†	72	20	47.6	1.32	
Rugby	72	18	45.4	2.17	
St. Joseph†	79	22	50.4	4.47	
Savannah	77	25	51.8	4.38	
Sewanee†	70	25	48.9	2.84	
Silver Lake	.....	.....	.....	1.35	T.
Springdale*‖	74	19	46.4	1.55	
Sylvia	76	20	50.2	3.49	
Tellico Plains†	76	21	51.4	1.97	
Tracy City	70	23	47.1	3.39	
Trenton	75	20	49.5	4.32	
Tullahoma†	72	22	48.8	3.50	
Union City†	79	21	49.8	4.17	
Waynesboro	77	22	51.2	4.06	
Wildersville	77	24	50.6	4.22	
Texas.					
Arthur City†	.....	.....	.....	0.65	
Austin *a*	.....	.....	.....	0.00	
Austin *b*§	80	31	57.6	.....	
Ballinger†	87	26	57.5	0.11	
Beeville†	92	34	64.6	T.	
Blanco†	84	38	63.3	0.25	
Boerne*‖	83	34	59.3	0.12	
Brazoria†	82	37	62.4	0.82	
Brenham†	84	34	60.6	1.33	
Brownwood	84	24	56.3	0.50	
Burnet*‖	82	30	56.4	0.08	
Camp Eagle Pass†	94	31	63.2	0.04	
Childress	83	15	53.3	0.05	
Coleman	85	22	55.4	0.00	
College Station	82	33	60.1	1.28	
Colmesneil	.....	.....	.....	1.09	
Columbia†	84	32	61.6	0.15	
Conroe	85	31	61.5	1.69	
Corsicana *b*†	82	26	54.9	0.15	
Cuero†	80	35	60.4	1.18	
Dallas†	81	22	54.2	1.22	
Danevang†	88	31	61.1	0.33	
Dublin†	81	23	54.8	0.42	
Duval*‖	82	35	62.8	0.03	
Emory	84	21	56.2	0.63	
Estelle†	82	18	53.7	0.55	
Forestburg†	82	20	53.1	0.22	
Fort Brown	88	43	65.7	3.03	
Fort Clark	86	4	60.7	0.00	
Fort McIntosh	95	32	66.6	0.00	
Fort Ringgold†	94	34	68.0	1.70	
Fort Stockton	.....	.....	.....	0.00	
Fort Worth	87[b]	25[b]	55.4[b]	0.10	
Fredericksburg*†	80[d]	30[b]	57.2[c]	0.20	
Fruitland	85	21	54.4	T.	
Gainesville	88	20	54.1	0.43	
Georgetown*‖	80[d]	31	57.2[c]	0.10	
Golindo	.....	.....	.....	1.10	
Grapevine†	83	21	55.2	0.26	
Hale Center†	84	20	52.1	T.	
Hallettsville†	85	34	61.7	0.31	
Haskell	91[b]	19	55.2[c]	0.25	
Hewitt	.....	.....	.....	T.	
Houston†	84	38	62.2	1.08	
Huntsville†	81	32	58.2	1.78	
Jacksonville	85	27	58.3	0.94	
Junction City[1]	83	31	60.9	0.00	
Kerrville	84	22	56.2	0.15	
Lampasas†	88	23	56.2	0.08	
Llano*†[5]	83	30	59.3	T.	
Longview†	85	29	55.8	1.93	
Luling†	84	34	61.4	0.78	
Marshall	88[c]	30[c]	57.9[c]	0.97	
Menardville	85	21	54.9	0.00	
Midland	91	19	55.4	0.00	
Mount Blanco†	85	15	51.2	0.40	
New Braunfels†	85	32	60.5	0.32	
Panter	.....	.....	.....	0.51	
Paris†	81	24	54.7	0.70	
Point Isabel*‖	86	54	70.1	1.80	
Rheinland†	89	20	55.4	0.24	
Roby	88	12	54.5	0.30	
Runge†	93	36	65.4	0.00	
Sanderson†	85	22	54.4	0.25	
San Marcos *b*†	84	29	59.6	0.33	
Sulphur Springs†	82	22	57.3	0.77	
Temple *a*	80	29	56.4	0.93	
Tulia	84	8	49.6	0.00	
Tyler	84	29	55.4	0.91	
Valentine†	.....	.....	.....	0.00	
Waco†	82	28	57.4	T.	
Waxahachie†	80	32	52.5	0.40	
Weatherford†	83	23	54.3	0.35	
Wichita Falls†	.....	.....	.....	0.83	
Utah.					
Alpine City†	.....	.....	.....	0.99	.....
Blue Creek*§	60	22	38.8	0.30	3.0
Brigham City†	.....	.....	.....	1.77	.....
Cisco†	69	12	41.9	0.35	
Corinne	63	16	38.5	0.67	2.0
Ferron	62	20	40.7	0.05	0.5
Fillmore†	78	6	36.6	1.15	.....
Fort Duchesne†	60	10	34.6	0.00	
Frisco	67	16	43.0	0.45	.....
Giles†	65	17	39.4	0.55	1.5
Heber	68	6	36.5	1.00	10.0
Huntsville	.....	.....	.....	1.53	.....
Kelton*§	57	15	35.8	.....	.....
Levan†	67	7	38.6	1.23	5.0
Loa†	67	− 1	31.9	0.27	0.5
Logan†	65	22	39.8	2.44	.....
Millville	.....	.....	.....	1.84	.....
Minersville	66	13	41.2	0.49	.....
Moab†	65	22	41.0	0.48	1.0
Mount Pleasant†	72	9	40.8	0.75	5.5
Ogden *a**§	65	26	41.4	1.51	6.0
Ogden *b*	.....	.....	.....	1.37	7.0
Pahreah	69	16	40.5	0.04	0.4
Parowan†	66	7	39.6	0.73	5.7
Pinto	68	0	37.2	0.40	4.0
Promontory	62	3	36.2	0.90	2.5
Richfield†	72	18	40.8	.....	.....
St. George†	76	17	46.2	0.13	
Scipio†	68	8	39.8	1.55	12.0
Snowville	61	14	36.9	0.90	3.0
Soldier Summit†	60	− 1	29.6	1.34	13.3
Terrace*§	56	10	33.4	0.10	1.0
Tooele†	64[f]	30[f]	41.9[f]	1.83	
Vernal	58	17	36.9	0.42	2.0
Vermont.					
Brattleboro	61	6	36.4	7.52	10.5
Burlington†	55	14	36.4	4.41	6.0
Chelsea†	55	0	30.8	5.91	15.0
Cornwall	63	0	34.2	5.41	7.0
Enosburg Falls	63	10	35.0	4.63	4.5
Hartland†	59	− 3	31.6	6.78	7.8
Jacksonville	55	0	33.7	9.24	13.3
Vermont—Cont'd.	°	°	°	*Ins.*	*Ins.*
St. Johnsbury	56	6	32.6	5.19	5.5
Strafford*†‖	52	7	27.8	5.35	13.5
Vernon*§	59	2	35.8	7.41	3.6
Wells	58	0	34.1	6.59	17.0
Virginia.					
Alexandria	74	24	44.8	3.44	
Ashland†	80	22	49.5	3.47	
Barboursville	73	21	45.7	2.16	
Bedford City	75	21	48.3	2.52	
Bigstone Gap†	77	15	44.2	1.31	
Birdsnest*†‖	78	32	51.2	2.05	
Blacksburg	71	13	43.5	1.34	
Buckingham†	75	17	45.2	3.47	
Burkes Garden	.....	.....	.....	2.50	
Callaville†	75	19	49.4	3.19	
Christiansburg	.....	.....	.....	0.81	
Clarksville	.....	.....	.....	1.03	
Clifton Forge	71	19	43.6	2.64	T.
Dale Enterprise†	71	14	43.4	2.40	T.
Doswell	75	18	45.8	2.57	
Dwale	.....	.....	.....	0.70	
Farmville	77	22	49.9	1.50	
Fredericksburg†	77	23	47.1	1.99	
Grahams Forge	70	13	40.2	1.34	
Guinea	.....	.....	.....	2.10	
Hampton	72	32	53.2	2.36	
Hot Springs	70	18	44.2	2.02	T.
Leesburg	72	20	46.2	2.94	
Lexington†	76	18	46.0	2.44	
Maidens	.....	.....	.....	3.06	
Manassas†	75	22	46.6	4.34	
Marion†	70[f]	15[f]	43.7[f]	1.55	
Monterey	66	10	39.6	4.10	T.
Nottoway	78	18	50.8	4.06	
Petersburg†	76	22	50.8	2.78	
Richmond (near)†	76	21	49.4	4.37	
Rockymount†	74	20	50.2	2.22	
Salem†	79	23	51.0	1.25	
Speers Ferry	.....	.....	.....	1.27	
Spottsville†	76	24	50 5	3.25	
Stanardsville†	73	17	45.0	2.68	
Staunton†	72	19	47.2	2.14	T.
Stephens City†	73	20	44.8	3.79	
Sunbeam†	72	25	48.3	2.84	
Warrenton	68	28	46.4	2.84	T.
Warsaw†	72	22	48.4	2.65	
Westbrook Farm	75	24	48.6	.....	
Woodstock†	70	20	42.1	2.20	T.
Wytheville†	71	19	47.2	1.26	T.
Washington.					
Aberdeen	57	30	43.1	16.91	
Anacortes	.....	.....	.....	5.01	0.5
Ashford†	.....	.....	.....	19.19	27.0
Blaine†	58	10	34.0	7.01	3.0
Cascade Tunnel	50	4	29.8	.....	131.0
Centerville†	71	16	39.0	3.11	11.0
Chehalis†	63	30	44.2	11.68	4.0
Clearwater	.....	31	.....	23.85	1.0
Colfax†	62	13	37.8	5.93	16.4
Coupeville†	57	25	42.1	4.42	3.0
Dayton†	72	8	39.3	3.90	.....
Ellensburg	63	6	34.8	3.92	.....
Ellensburg (near)	60	10	34.5	4.93	14.0
Fort Simcoe†	65	8	37.2	5.47	17.0
Fort Spokane	63	8	32.8	5.10	22.0
Grandmound†	60	30	42.9	13.18	2.8
Hunters†	57	− 5	28.6	4.20	30.5
Kennewick†	78	16	42.5	3.38	2.0
La Center	62	30	43.0	13.78	3.0
Lakeside	59	9	34.2	2.93	15.5
Lapush	55	28	43.2	14.26	T.
Loomis†	50	2	31.9	0.85	2.0
Madrone†	64	26	42.0	9.05	
Mayfield†	63	28	43.6	14.37	
Moxee Valley†	70	9	40.0	3.11	14.1
New Whatcom	63	30	42.2	5.74	2.0
Northbend	62[e]	28[e]	40.7[e]	22.07[d]	5.0
Olga	54	24	39.6	49.2	2.0
Olympia†	60	29	43.4	13.01	T.
Pinehill†	69	30	41.5	6.34	13.0
Pomeroy	64	15	37.6	4.74	8.0
Port Townsend	60	28	44.1	2.99	1.2
Pullman†	64	3	36.7	5.28	5.0
Rosalia†	63	− 3	35.0	6.52	19.5
Sedro†	72	23	41.4	9.86	T.
Shoalwater Bay*§	61	33	46.9	.....	
Snohomish†	59	28	43.4	9.68	
Southbend	60	32	44.4	18.68	
Stampede	58	14	33.4	13.15	41.0
Sunnyside†	73	12	39.3	3.03	3.5
Union City†	59	26	42.6	19.41	1.0
Vashon†	60	29	43.3	12.35	0.5
Waterville†	60	−10	29.8	2.85	17.5
West Virginia.					
Beckley	71	16	43.8	0.30	
Beverly†	70	14	40.3	5.21	T.

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
West Virginia—Cont'd.	°	°	°	*Ins.*	*Ins.*
Bluefield†	70	15	47.2	1.42	
Buckhannon *a*†	.....	.....	.....	6.19	0.8
Buckhannon *b*	78	15	42.7	.....	
Burlington†	70	17	43.3	3.84	T.
Charleston†	.....	.....	.....	4.07	
Dayton†	70	17	43.4	3.78	
Eastbank	76	21	48.6	2.96	T.
Elkhorn†	71	18	49.1	0.92	
Fairmont†	.....	.....	.....	6.35	T.
Glenville†	72	16	43.9	6.00	
Grafton†	74	16	43.2	4.89	0.5
Green Sulphur	76	18	45.8	1.04	
Harpers Ferry†	.....	.....	.....	5.56	
Hinton *a*†	.....	.....	.....	1.00	.....
Hinton *b*†	71	18	46.2	.....	T.
Huntington	72	17	46.0	5.02	
Kingwood	65[5]	13	43.4[4]	7.15	.....
Marlinton†	68	13	39.7	4.08	1.0
Martinsburg†	71	20	41.9	4.70	
Morgantown *b*†	72	15	44.9	5.24	T.
New Martinsville†	72	17	45.4	6.69	
Oldfields†	70	17	42.0	2.93	T.
Point Pleasant†	72	18	45.6	6.40	T.
Powellton	73	21	47.0	2.99	
Romney	69	21	44.0	4.56	T.
Rowlesburg†	.....	.....	.....	6.70	1.0
Upper Tract	76	20	46.0	.....	.....
Weston *a*	.....	.....	.....	6.71	.....
Weston *b**†[1]	72	20	44.4	.....	T.
Wheeling *a*†	.....	.....	.....	6.47	T.
Wheeling *b*†	69	18	45.4	6.93	T.
Wisconsin.					
Amherst	65	−14	29.5	1.40	6.0
Barron	50	−16	23.0	0.29	2.9
Bayfield	55	− 1	27.3	1.06	2.5
Beloit	64	− 2	34.8	1.05	2.2
Brodhead	68	− 3	33.2	1.36	1.0
Butternut	69	−19	25.6	1.25	11.2
Chilton	63	− 5	32.4	1.86	1.8
Citypoint	64	−10	29.4	1.16	6.5
Crandon	75	−11	32.0	1.62	12.2
Delavan	65	− 7	34.0	1.74	1.0
Dodgeville†	63	− 6	30.8	1.77	1.7
Easton	67	−13	30.4	1.40	9.5
Eau Claire	64	−11	28.6	0.92	7.0
Florence†	57	− 8	26.8	1.71	11.0
Fond du Lac	61	− 4	32.4	2.23	6.5
Grand River Locks	.....	.....	.....	1.21	4.0
Grantsburg†	63	−12	27.2	1.04	7.0
Gratiot	66	− 2	33.1	0.60	T.
Hartford	58	− 7	29.3	1.76	7.0
Hartland	65	0	34.2	1.31	0.8
Harvey	65	− 3	34.0	2.03	4.4
Hayward	48	−18	25.4	1.32	11.2
Hillsboro	67	−10	30.2	1.52	5.5
Kenosha*[10]	58	− 2	34.7	.....	.....
Koepenick*†[1]	62	− 8	30.0	1.00	7.0
Lancaster†	69	− 5	31.0	1.32	1.5
Lincoln†	61	− 4	32.2	1.64	6.0
Madison†	61	0	33.1	1.33	3.1
Manitowoc†	58	0	33.0	1.98	2.5
Meadow Valley†	69	−14	29.2	1.08	5.0
Medford†	69	−16	27.0	0.03	0.4
Menasha	.....	.....	.....	1.25	6.0
Neillsville†	64	−14	27.4	1.32	8.0
New London	61	− 8	30.4	2.00	4.5
Oconto	60	− 2	31.8	2.29	6.5
Osceola†	66	−25	26.2	1.32	9.0
Pepin	70	−12	29.9	0.60	5.0
Pine River†	64	− 8	31.0	1.73	8.7
Portage†	63	− 4	30.0	1.08	4.0
Port Washington	68	− 3	34.8	1.69	6.5
Prairie du Chien	70	− 4	37.3	0.96	0.5
Racine	66	3	37.4	1.92	0.5
Sharon	65	− 5	31.8	1.54	0.5
Shawano	60	− 7	30.6	1.29	3.0
Sheboygan*[10]	64	4	35.3	.....	.....
Spooner†	64	−14	26.7	1.50	15.0
Stevens Point†	66	−12	29.2	1.17	5.2
Sturgeon Bay Canal*[10]	53	4	32.5	.....	
Wisconsin—Cont'd.	°	°	°	*Ins.*	*Ins.*
Two Rivers*[10]	53	2	34.6	.....	
Valley Junction†	70	−13	30.4	1.25	6.5
Viroqua	66	− 8	31.3	0.98	4.8
Watertown†	62	− 7	32.4	1.56	6.0
Waukesha†	62	2	33.6	1.25	0.9
Waupaca†	62	−13	30.2	1.64	8.0
Wausau†	58	−10	26.9	0.97	7.0
Wausaukee	58	− 4	28.8	1.43	6.0
Westbend	60	2	31.8	1.54	6.1
Westfield†	61	− 2	30.1	1.28	4.0
Whitehall	67	−20	28.1	1.17	6.6
White Mound†	69	− 6	32.2	1.33	2.0
Wyoming.					
Atlantic City	54	0	28.4	0.20	2.0
Big Horn Ranch	68	− 1	30.8	0.35	6.8
Carbon	67	7	38.8	0.12	0.4
Fort Laramie†	76	−10	35.8	0.63	7.6
Fort Washakie	68	4	34.2	0.42	4.2
Fort Yellowstone†	59	1	30.2	2.98	20.5
Green River	71	10	41.4	0.65	5.5
Laramie	64	0	34.9	.....	.....
Lovell	67	−13	30.0	0.29	6.0
Lusk†	72	−14	30.0	0.65	.....
Sheridan	76	−16	27.8	0.73	4.0
Sundance	60	−11	26.0	1.53	15.0
Wamsutter	62	5	30.8	0.20	2.0
Wheatland	76	− 6	42.2	0.70	7.0
Mexico.					
Ciudad P. Diaz	84	38	62.6	T.	
Leon de Aldamas	80	35	61.2	0.05	
Topolobampo*[1]	85	60	74.2	0.04	
New Brunswick.					
St. John	54	8	35.3	8.28	6.6
West Indies.					
Grand Turk island	.....	.....	.....	8.17	
Oregon.	°	°	°	*Ins.*	*Ins.*
Fort Klamath	74	14	43.4	1.16	1.8
Texas.					
Gainsville	91	39	67.6	2.57	
Missouri City	96	45	75.4	5.10	
Vermont.					
Woodstock	.....	.....	.....	1.06	

Late reports for October, 1897.

Alabama.					
Birmingham	93	40	69.6	0.56	
Alaska.					
Coal Harbor	55	24	40.1	6.81	1.6
Kilisnoo	51	31	41.2	11.95	
Arizona.					
Antelope Valley	.....	.....	.....	0.00	
Benson**	87	43	66.3	0.00	
Flagstaff	.....	.....	.....	0.14	
Pinal Ranch	.....	.....	.....	0.70	
Tuba	83	27	52.4	1.73	T.
Florida.					
Earnestville	89	54	73.1	3.35	
Merritts Island	86	60	74.8	10.81	
Illinois.					
Cordova	.....	.....	.....	0.40	
Iowa.					
Stuart	93	31	58.8	2.65	
Kansas.					
Hays	93	27	62.6	3.75	
Norton	91	28	55.9	.....	
Osborne	.....	.....	.....	5.15	
Louisiana.					
Melville	.....	.....	.....	3.78	
Shellbeach	87	52	73.4	5.05	
Minnesota.					
Lutsen	72	23	45.8	2.39	
Missouri.					
New Madrid	....	.....	.....	1.40	
Nebraska.					
Alma	.....	.....	.....	5.56	
Blair	.....	.....	.....	1.51	
Kirkwood	.....	.....	.....	4.68	
Springview	.....	.....	.....	2.75	
New Mexico.					
Monero	79[4]	13[4]	45.1[4]	1.99	5.0
North Carolina.					
Horse Cove	82	36	60.2	3.35	

EXPLANATION OF SIGNS.

* Extremes of temperature from observed readings of dry thermometer.

† Weather Bureau instruments.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. + 4.
[2] Mean of 8 a. m. + 8 p. m. ÷ 2.
[3] Mean of 7 a. m. + 7 p. m. ÷ 2.
[4] Mean of 6 a. m. + 6 p. m. ÷ 2.
[5] Mean of 7 a. m. + 2 p. m. ÷ 2.
[6] Mean of readings at various hours reduced to true daily mean by special tables.
[7] Mean from hourly readings of thermograph.
[8] Mean of 7 a. m. + 2 p. m. + 9 p. m. ÷ 3.
[9] Mean of sunrise and noon.
[10] Mean of sunrise, noon, sunset, and midnight.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance, "[a]" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks, of whatever duration, in the precipitation record receive appropriate notice.

CORRECTIONS.

Arizona, October, 1897, make Benson read Casa Grande.

Iowa, Portsmouth, October, 1897, make precipitation read 1.41.

Michigan, Berlin, October, 1897, make precipitation read 1.87.

Nebraska, Creighton, October, 1897, make precipitation read 2.10.

Ohio, Waverly, February, 1897, make mean temperature read 38.0. Carrollton, make precipitation read 3.73. Norwalk, March, 1897, make precipitation read 3.44. Logan, June, 1897, make precipitation read 1.51. Milfordton, make mean temperature read 64.5. North Royalton, make mean temperature read 65.4. Fayetteville, August, 1897, make mean temperature read 71.2. Carrollton, September, 1897, make mean temperature read 64.8.

Texas, Forestburg, January, 1897, make precipitation read 2.27. Graham, make maximum temperature read 69. Stafford, make mean temperature read 49.4. Cuero, March, 1897, make minimum temperature read 35. Camp Eagle Pass, April, 1897, make minimum temperature read 50. Cuero, make minimum temperature read 41. Fort McIntosh, make maximum temperature read 96. Childress, May, 1897, make mean temperature read 67.0. Bremond, June, 1897, make mean temperature read 82.0. Camp Eagle Pass, make minimum temperature read 65. Fort McIntosh, make minimum temperature read 63.

October, 1897, Table III, Canadian data, make mean reduced pressure at Hamilton, Bermuda, read 30.04.

Title of Chart VI, Review of October, 1897, for "depth of snow on ground at the close of the month," read "total snowfall during the month."

Page 449, second column, last line, for "depth of snow on ground at the close of the month," read "total snowfall during the month."

TABLE III.—*Data from Canadian stations for the month of November*, 1897.

Stations.	Pressure.			Temperature.		Precipitation.		Prevailing direction of wind.	Total depth of snow.
	Mean not reduced.	Mean reduced.	Departure from normal.	Mean.	Departure from normal.	Total.	Departure from normal.		
	Inches.	*Inches.*	*Inches.*	°	°	*Inches*	*Inches.*		
St. Johns, N. F	29.68	29.83	— .10	35.4	— 1.1	6.12	.....	n.	5.4
Sydney, C. B. I	29.89	29.95	— .01	36.4	— 0.7	4.66	— 0.95	nw.	10.0
Halifax, N. S	29.88	30.01	+ .01	37.2	— 0.1	6.04	— 0.82	w.	0.9
Grand Manan, N. B.	29.92	29.97	— .06	37.0	— 1.9	8.15	+ 3.92	w.	1.4
Yarmouth, N. S. ...	29.93	30.01	— .03	39.0	— 0.9	7.40	+ 4.46	nw.	5.1
Charlottet'n, P. E. I.	29.90	29.94	— .08	34.6	— 0.9	5.62	+ 1.89	nw.	2.2
Chatham, N. B	29.94	29.96	— .02	29.8	— 1.2	6.78	+ 3.36	nw.	4.6
Father Point, Que..	29.94	29.97	+ .01	27.7	— 1.2	5.97	+ 3.51	n.	36.5
Quebec, Que.....	29.62	29.96	— .05	27.6	— 1.4	3.34	— 0.68	w.	12.7
Montreal, Que	29.80	30.02	.00	30.0	— 1.8	5.03	+ 1.86	sw.	18.6
Rockliffe, Ont.....	29.48	30.03	+ .03	26.2	— 2.4	2.30	— 0.35	se.	6.2
Kingston, Ont.....	29.70	30.02	— .02	35.3	+ 0.3	2.81	— 0.61	ne.	....
Toronto, Ont	29.64	30.03	— .02	37.0	+ 1.4	3.86	+ 0.91	sw.	1.7
White River, Ont ..	28.64	30.07	+ .03	16.6	— 3.9	2.22	+ 0.33	w.	22.2
Port Stanley, Ont ..	29.40	30.05	.00	37.7	+ 0.9	4.59	+ 1.44	w.	2.7
Saugeen, Ont	29.28	30.01	— .01	35.7	+ 0.7	3.04	— 0.86	nw.	9.4
Parry Sound, Ont..	29.28	30.00	— .02	31.3	— 0.8	3.26	— 0.95	e.	13.7
Port Arthur, Ont ..	29.32	30.06	+ .05	21.6	— 2.4	1.06	— 0.92	w.	4.9
Winnipeg, Man	29.22	30.11	+ .04	13.1	— 4.9	0.72	— 0.27	w.	7.2
Minnedosa, Man ...	28.24	30.16	+ .12	12.3	— 5.0	0.62	— 0.18	w.	6.2
Qu'Appelle, Assin..	27.72	30.13	+ .10	9.7	— 9.1	1.14	+ 0.54	nw.	11.4
Medicine Hat, Assin	27.71	30.16	+ .12	13.6	—13.8	3.11	+ 2.78	s.	31.1
Swift Curr't, Assin.	27.43	30.18	+ .12	12.6	—10.6	1.50	+ 0.99	w.	14.6
Calgary, Alberta...	.....	.....	.....	.....	.....	.....	.....	.....	....
Prince Albert, Sask.	28.51	30.14	.....	8.8	— 6.6	1.83	.....	w.	18.3
Edmonton, Alberta.	27.69	30.18	+ .16	11.2	—11.7	1.10	+ 0.88	nw.	10.0
Battleford, Sask ...	28.30	30.16	... .	8.6	— 5.1	1.10	..... .	w.	11.0
Kamloops, B. C.	28.61	29.91	.....	26.4	.....	2.42	.....	sw.	21.5
Hamilton, Bermuda	30.00	30.16	+ .11	68.3	— 0.4	1.49	.....	ne.	
Banff, Alberta.....	25.26	30.15	... .	11.2	... .	3.58	.....	sw.	26.5
Esquimalt, B. C.....	29.96	29.99	.....	40.8	— 0.8	7.29	....	n.	0.8
Ottawa, Ont	29.69	30.06	.....	28.0	— 3.7	2.77	.....	nw.	5.8

TABLE IV not received.

TABLE V.—*Mean temperature for each hour of seventy-fifth meridian time, November*, 1897.

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Bismarck, N. Dak.	20.6	20.0	18.6	17.6	17.2	16.1	15.8	16.0	15.2	16.7	19.9	23.3	26.8	29.2	31.1	31.9	31.6	29.7	26.4	24.4	22.9	22.5	21.3	20.5	22.3
Boston, Mass.	39.9	39.7	39.3	39.1	38.6	38.2	38.2	38.8	40.0	41.2	43.0	44.4	45.4	46.0	46.0	45.5	44.8	43.7	42.7	42.1	41.7	40.7	39.7	39.1	41.6
Buffalo N Y.	40.0	39.5	39.5	39.3	38.9	38.9	38.6	39.0	39.5	40.3	41.1	41.6	41.9	41.8	41.8	41.8	41.3	41.2	40.5	40.9	39.8	39.9	39.6	39.3	40.2
Chicago, Ill.	38.4	37.9	37.3	36.8	36.4	35.8	35.4	35.6	35.4	36.0	37.5	39.1	40.2	40.9	41.5	43.1	41.8	41.3	40.8	40.5	39.8	39.0	38.6	38.1	38.6
Cincinnati, Ohio	45.3	45.0	44.5	44.1	43.3	42.7	42.3	42.2	42.2	43.4	45.2	46.5	47.8	48.8	49.8	50.2	50.3	49.4	48.4	47.4	46.7	46.2	45.4	45.1	45.9
Cleveland, Ohio	41.2	41.2	41.0	40.7	39.9	39.8	39.4	39.4	39.7	40.3	41.1	42.0	42.6	43.2	43.8	44.0	43.8	43.4	42.9	42.3	41.5	40.9	41.0	40.6	41.5
Detroit, Mich.	37.7	37.4	36.9	36.9	36.5	36.4	36.5	36.6	37.1	38.2	39.3	40.2	40.6	41.5	42.0	41.8	41.3	40.5	39.8	39.5	39.0	38.7	38.1	37.7	38.8
Dodge City, Kans.	37.0	36.0	34.9	34.1	33.5	32.5	31.1	30.1	29.7	32.8	38.5	43.9	47.9	50.5	53.1	54.4	55.1	53.4	48.6	43.6	42.3	40.2	38.7	38.0	40.8
Eastport, Me.	35.5	35.3	35.0	34.7	34.5	34.4	34.4	34.5	35.1	36.0	36.5	37.4	37.8	38.0	37.8	37.5	37.1	36.7	36.3	36.1	35.6	35.3	35.3	35.1	35.9
Galveston, Tex.	64.6	64.4	64.2	63.9	63.2	63.0	62.5	62.2	62.3	63.0	64.4	65.3	66.1	66.9	67.5	67.6	67.8	67.2	66.4	65.9	65.6	65.4	65.0	64.7	65.0
Havre, Mont.	17.4	17.0	17.1	16.4	16.5	15.9	15.7	15.5	15.2	14.3	15.0	16.8	18.7	19.8	20.4	20.7	21.8	21.4	20.4	19.4	18.5	17.9	17.4	16.6	17.7
Kansas City, Mo.	41.1	40.4	39.6	38.3	37.6	37.2	36.5	36.3	36.5	38.5	41.2	43.9	46.4	48.5	50.3	50.8	51.0	50.1	48.5	46.7	45.2	44.0	42.8	41.8	43.1
Key West, Fla.	74.2	74.1	74.0	73.7	73.8	73.8	74.0	74.5	75.7	76.3	77.0	77.4	77.5	77.5	77.6	77.1	76.6	75.8	75.3	75.2	74.7	74.6	74.3	74.1	75.4
Memphis, Tenn.	51.2	50.1	49.7	49.0	48.0	47.3	47.0	46.7	46.9	49.0	51.3	53.7	55.5	57.2	58.7	59.7	59.9	58.7	56.9	55.4	54.2	53.2	52.3	51.3	52.6
New Orleans, La.	60.3	59.9	59.3	58.8	58.4	57.7	57.3	57.8	58.8	61.8	65.1	67.6	69.0	69.9	69.8	69.7	69.0	67.1	64.9	63.4	62.5	61.6	61.2	60.7	63.0
New York, N. Y.	42.9	42.4	42.0	41.8	41.5	41.7	41.7	41.9	42.5	43.5	45.1	46.3	46.5	47.6	46.9	46.4	45.6	44.9	44.5	44.5	43.5	43.2	42.7	42.4	43.8
Philadelphia, Pa.	43.8	43.3	42.8	42.4	42.2	42.1	42.1	43.0	44.5	46.1	47.6	49.1	50.2	50.7	50.7	50.3	49.3	48.4	47.4	46.7	45.5	45.1	44.3	43.6	45.9
Pittsburg, Pa.	43.7	43.2	42.9	42.2	41.9	41.9	42.4	42.4	42.9	44.5	46.1	47.2	47.8	48.4	48.8	48.4	47.9	47.0	46.2	45.5	44.9	44.4	43.8	43.0	44.9
Portland, Oreg.	44.6	44.2	43.5	43.2	43.1	42.6	42.2	42.3	42.0	41.8	41.5	42.1	42.7	43.9	45.3	46.2	46.7	47.2	47.6	46.6	45.8	45.0	44.7	44.5	44.1
St. Louis, Mo.	44.6	44.5	43.8	43.3	42.4	41.8	40.8	40.3	40.5	42.1	43.9	46.2	48.1	49.7	50.7	51.6	51.5	50.4	48.9	47.8	47.1	46.5	45.8	45.3	45.7
St. Paul, Minn.	27.5	26.9	26.2	25.8	25.4	24.9	24.5	24.6	24.4	25.0	26.7	28.9	31.2	32.7	34.3	34.9	34.9	34.2	32.6	31.6	30.2	29.3	28.3	27.2	28.8
Salt Lake City, Utah.	40.6	40.0	40.0	39.0	38.5	38.5	38.9	39.3	38.0	37.9	39.1	41.9	44.6	47.0	48.1	48.8	48.7	48.1	46.5	44.0	43.0	41.9	40.8	41.0	42.3
San Diego, Cal.	56.8	56.4	55.8	55.5	54.8	54.3	53.8	53.8	53.4	53.7	56.2	60.9	64.2	65.9	66.0	66.2	66.1	65.2	64.0	62.1	60.9	59.7	58.3	57.7	59.2
San Francisco, Cal.	52.2	51.5	51.0	50.6	50.1	49.8	49.6	49.4	49.3	48.9	49.1	50.2	51.6	52.8	54.8	55.9	56.7	57.1	56.3	54.4	53.9	53.5	52.9	52.4	52.2
Savannah, Ga.	57.5	56.8	55.9	55.2	54.3	54.0	53.2	54.5	57.6	61.6	65.0	67.4	68.7	69.3	68.7	68.5	66.6	64.4	62.8	61.6	60.8	59.7	58.6	57.7	60.9
Washington, D. C.	43.3	42.6	41.9	41.7	41.3	41.1	41.1	42.2	44.3	46.3	48.4	49.7	51.1	52.1	52.4	51.8	50.6	49.1	47.7	46.3	45.2	44.4	43.6	43.1	45.9

TABLE VI.—*Mean pressure for each hour of seventy-fifth meridian time, November*, 1897.

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Bismarck, N. Dak.	28.275	.274	.270	.273	.268	.269	.271	.270	.275	.284	.289	.294	.292	.281	.268	.260	.263	.272	.280	.284	.286	.287	.287	.288	.278
Boston, Mass.	29.899	.900	.895	.902	.910	.922	.929	.930	.929	.914	.901	.889	.886	.887	.890	.898	.903	.904	.906	.907	.906	.905	.900	.904	
Buffalo, N. Y.	29.188	.189	.189	.188	.183	.181	.190	.188	.194	.196	.193	.183	.173	.170	.175	.179	.185	.193	.199	.199	.202	.199	.197	.198	.189
Chicago, Ill.	29.165	.163	.163	.164	.168	.174	.181	.191	.197	.203	.207	.200	.187	.177	.164	.164	.165	.167	.169	.171	.175	.173	.170	.168	.176
Cincinnati, Ohio	29.444	.442	.444	.440	.443	.444	.453	.464	.474	.478	.483	.473	.451	.437	.431	.431	.434	.439	.444	.445	.450	.451	.451	.450	.450
Cleveland, Ohio	29.236	.231	.230	.215	.218	.222	.228	.234	.245	.246	.247	.240	.234	.216	.212	.213	.220	.227	.231	.232	.234	.233	.232	.229	.228
Detroit, Mich.	29.253	.250	.247	.244	.242	.246	.248	.260	.267	.268	.271	.266	.252	.245	.241	.245	.251	.259	.263	.268	.266	.266	.261	.259	.256
Dodge City, Kans.	27.466	.464	.455	.456	.449	.446	.449	.454	.462	.468	.471	.468	.446	.426	.409	.402	.406	.412	.421	.439	.447	.454	.459	.461	.445
Eastport, Me.	29.886	.892	.890	.889	.888	.892	.903	.913	.916	.915	.901	.888	.880	.876	.876	.876	.881	.885	.887	.885	.886	.882	.881	.881	.890
Galveston, Tex.	30.104	.100	.096	.096	.096	.099	.108	.119	.134	.141	.144	.137	.118	.099	.083	.077	.074	.077	.086	.096	.103	.108	.110	.110	.105
Havre, Mont.	27.359	.363	.367	.371	.377	.378	.382	.384	.388	.394	.399	.401	.402	.387	.374	.362	.352	.351	.354	.355	.359	.360	.365	.368	.373
Kansas City, Mo.	29.100	.100	.102	.103	.101	.102	.105	.109	.115	.120	.121	.116	.093	.070	.053	.051	.052	.051	.063	.070	.078	.085	.093	.098	.090
Key West, Fla.	30.101	.092	.085	.082	.082	.089	.102	.117	.130	.136	.130	.114	.093	.077	.069	.064	.069	.078	.088	.103	.111	.115	.116	.109	.098
Memphis, Tenn.	29.731	.730	.730	.730	.730	.732	.738	.745	.753	.769	.778	.786	.784	.764	.746	.723	.715	.711	.714	.719	.726	.730	.735	.739	.741	.740
New Orleans, La.	30.113	.110	.106	.106	.110	.120	.131	.146	.160	.165	.160	.145	.120	.099	.087	.080	.082	.089	.100	.111	.119	.125	.125	.124	.118
New York, N. Y.	29.745	.747	.744	.741	.742	.746	.754	.764	.769	.768	.752	.736	.721	.711	.709	.714	.720	.725	.729	.733	.742	.749	.752	.752	.740
Philadelphia, Pa.	29.988	.989	.986	.982	.987	.990	.000	.008	.011	.008	.996	.977	.962	.950	.952	.954	.958	.966	.973	.979	.989	.993	.993	.991	.983
Pittsburg, Pa.	29.190	.191	.198	.198	.197	.196	.195	.198	.207	.207	.213	.201	.185	.174	.172	.179	.186	.193	.199	.202	.199	.196	.193	.192	.194
Portland, Oreg.	29.897	.902	.906	.906	.903	.903	.893	.890	.886	.887	.893	.901	.907	.911	.902	.895	.888	.883	.882	.877	.880	.884	.887	.891	.894
St. Louis, Mo.	29.500	.496	.501	.502	.507	.513	.525	.535	.549	.551	.552	.543	.517	.501	.486	.482	.482	.483	.488	.493	.497	.501	.505	.507	.509
St. Paul, Minn.	29.168	.169	.171	.176	.170	.170	.167	.167	.172	.176	.176	.171	.155	.139	.128	.123	.127	.133	.139	.146	.150	.154	.158	.162	.157
Salt Lake City, Utah	25.712	.713	.711	.713	.710	.707	.707	.709	.716	.726	.739	.747	.747	.731	.717	.706	.700	.703	.703	.709	.709	.706	.701	.701	.714
San Diego, Cal.	29.981	.981	.975	.972	.967	.963	.959	.961	.968	.977	.990	.005	.003	.993	.968	.951	.938	.934	.935	.939	.948	.956	.965	.971	.967
San Francisco, Cal.	30.012	.013	.016	.014	.016	.016	.014	.016	.017	.025	.039	.048	.051	.042	.016	.004	.992	.986	.981	.980	.988	.991	.998	.004	.012
Savannah, Ga.	30.099	.097	.095	.096	.099	.107	.120	.129	.139	.144	.137	.118	.088	.072	.065	.065	.070	.079	.089	.099	.102	.105	.109	.109	.101
Washington, D. C.	30.012	.012	.013	.012	.016	.019	.027	.038	.043	.045	.036	.010	.988	.977	.978	.981	.985	.996	.008	.016	.020	.024	.019	.021	.012

TABLE VII.—*Average wind movement for each hour of seventy-fifth meridian time, November, 1897.*

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Abilene, Tex.	9.4	10.0	9.8	9.5	9.5	9.1	9.3	9.6	9.9	10.9	13.0	13.7	14.3	13.8	13.6	13.5	14.0	13.2	10.8	8.4	8.6	8.9	9.2	9.2	10.9
Albany, N. Y.	8.3	8.3	8.9	8.7	8.5	8.5	8.3	8.9	9.2	9.7	9.9	10.7	11.5	11.4	11.0	10.6	9.6	8.8	9.2	8.9	9.0	8.9	8.3	8.0	9.3
Alpena, Mich.	9.8	10.6	10.3	10.3	9.9	9.7	9.4	10.1	11.2	11.4	12.1	12.5	12.6	12.5	12.7	13.3	11.9	11.0	10.9	11.2	11.5	10.8	11.2	10.6	11.2
Amarillo, Tex.	16.8	16.4	15.8	15.8	15.9	16.2	14.4	15.1	14.0	14.5	16.4	17.5	18.1	18.4	18.8	19.4	19.6	18.6	15.4	15.0	15.1	15.5	15.0	16.3	16.4
Atlanta, Ga.	10.4	9.8	9.7	9.8	10.1	10.2	10.2	10.4	10.2	10.6	11.2	11.9	12.5	11.6	11.6	11.2	10.3	8.5	8.9	10.4	10.3	10.3	10.1	10.4	10.4
Atlantic City, N. J.	12.0	11.4	11.9	11.8	11.9	11.7	10.7	11.5	13.5	14.6	15.2	15.3	15.3	15.0	14.9	14.1	12.6	11.3	12.2	11.2	11.3	12.0	12.3	11.9	12.7
Augusta, Ga.	4.8	4.7	4.3	4.3	4.2	4.5	4.1	4.5	5.5	6.6	7.9	8.6	9.6	9.2	9.8	9.0	7.8	5.9	5.3	4.9	4.7	4.2	4.4	4.8	6.0
Baker City, Oreg.	5.1	5.0	5.8	6.6	6.5	6.7	6.3	6.6	6.6	6.4	6.2	6.6	5.8	6.1	6.5	5.4	6.0	6.1	5.6	4.5	4.6	4.0	4.8	4.9	5.8
Baltimore, Md.	4.1	4.3	3.9	4.1	3.7	3.7	3.7	4.4	5.0	6.0	6.0	6.1	6.1	6.3	6.6	6.4	5.4	4.7	4.4	4.3	4.0	4.2	3.9	4.3	4.8
Bismarck, N. Dak.	5.4	5.3	5.9	5.5	6.0	5.9	6.5	6.7	6.1	6.9	9.0	9.9	11.4	12.7	12.9	12.9	12.3	10.5	8.5	7.4	7.1	6.5	6.3	5.3	8.0
Block Island, R. I.	19.4	18.6	18.1	18.2	17.2	16.5	15.8	16.4	16.6	16.8	15.7	16.9	17.0	16.7	16.4	17.0	17.6	17.6	18.7	18.4	19.5	19.7	19.7	19.2	17.6
Boston, Mass.	12.3	12.0	11.3	11.5	11.4	11.1	11.5	11.7	12.2	13.0	13.0	12.6	13.1	13.4	13.3	12.5	11.8	11.3	11.9	11.2	11.6	11.6	11.6	11.7	12.0
Buffalo, N. Y.	20.1	20.4	20.5	21.0	20.0	19.9	19.1	18.5	18.7	18.8	18.8	19.5	18.8	18.8	19.1	19.1	17.8	17.6	17.5	17.8	17.7	18.7	19.2	19.2	19.0
Cairo, Ill.	10.6	10.6	10.7	10.1	9.9	9.5	9.7	9.2	9.6	10.8	10.7	10.8	11.6	11.5	11.3	11.3	11.2	9.7	9.7	10.2	9.7	9.7	9.5	9.1	10.3
Cape Henry, Va.	15.7	15.5	15.7	15.4	14.4	14.4	14.5	14.2	14.7	15.0	14.9	15.1	15.2	15.2	15.9	14.8	13.9	13.5	13.5	14.2	15.0	15.7	15.6	16.1	14.9
Carson City, Nev.	7.9	7.1	7.5	6.6	5.3	5.2	4.9	4.5	5.1	4.7	5.1	5.1	6.1	8.5	10.0	10.9	11.6	11.7	10.3	10.5	9.6	7.6	7.8	8.9	7.6
Charleston, S. C.	9.8	9.6	9.9	10.1	9.9	10.1	9.7	10.1	10.6	10.5	11.1	11.7	12.1	11.9	11.9	11.7	11.2	9.7	9.6	9.3	9.0	9.5	9.7	9.7	10.4
Charlotte, N. C.	7.1	7.6	7.4	6.9	6.9	6.6	6.4	6.5	7.4	8.5	8.9	9.6	10.1	10.7	10.7	9.2	8.0	6.6	6.6	6.9	6.9	6.7	7.2	7.1	7.8
Chattanooga, Tenn.	5.7	5.8	5.8	6.2	5.9	5.9	5.4	5.5	5.8	6.7	7.5	9.5	10.3	10.3	11.0	10.6	10.3	8.6	7.9	7.3	6.3	6.0	5.8	5.9	7.3
Cheyenne, Wyo.	9.9	9.9	10.4	11.4	11.6	10.5	10.6	11.6	12.1	12.0	12.1	14.1	15.6	16.4	16.5	14.9	13.4	12.0	10.5	9.8	10.4	10.2	10.0	10.1	11.9
Chicago, Ill.	20.1	19.4	19.8	19.6	19.1	19.1	19.1	18.9	20.0	19.7	20.2	20.3	20.9	19.1	19.2	19.7	19.7	19.8	20.3	20.1	20.7	20.8	20.7	20.5	19.9
Cincinnati, Ohio.	7.1	7.1	7.3	7.0	7.3	7.0	7.2	8.5	9.0	10.1	10.2	10.5	10.3	10.1	10.2	9.7	8.7	8.0	7.4	7.2	7.2	7.3	7.2	7.2	8.3
Cleveland, Ohio.	20.4	20.4	19.9	19.6	19.1	18.3	19.1	20.1	19.2	18.8	19.4	18.7	18.6	18.2	17.9	17.5	18.3	18.6	18.8	19.3	19.6	19.3	19.7	20.1	19.1
Columbia, Mo.	8.5	8.9	8.6	8.9	9.1	9.0	9.3	9.5	9.7	10.1	10.5	10.7	11.8	11.4	11.5	11.5	10.4	8.7	8.0	8.1	8.9	8.9	8.4	8.9	9.6
Columbus, Ohio.	7.6	7.3	7.3	7.7	8.2	8.1	7.7	7.8	8.2	9.4	10.6	10.4	10.5	10.4	10.2	9.9	8.5	8.0	7.9	7.8	7.7	8.1	8.6	7.9	8.6
Concordia, Kans.	6.3	6.8	7.0	6.8	6.4	6.1	5.9	6.2	6.3	6.7	8.2	8.9	8.9	8.8	8.7	8.9	8.3	6.3	5.3	5.4	5.7	5.6	6.1	6.1	6.9
Corpus Christi, Tex.	8.4	8.3	8.1	8.5	8.1	7.9	8.7	9.1	9.7	10.3	10.5	10.9	12.4	12.9	13.2	13.5	13.5	12.7	12.0	10.4	10.1	9.5	8.3	8.0	10.2
Davenport, Iowa.	6.9	6.6	7.2	6.9	6.8	7.3	7.4	7.4	7.6	7.7	8.7	9.2	10.1	10.2	10.1	10.2	9.9	8.5	7.7	7.0	6.8	6.3	6.7	7.0	7.9
Denver, Colo.	7.6	7.5	7.6	7.2	7.9	8.0	8.4	9.3	9.2	8.5	8.3	7.7	9.1	9.0	8.8	7.6	8.0	7.5	6.7	6.1	6.7	6.4	6.2	7.0	7.8
Des Moines, Iowa.	7.2	6.9	7.0	6.8	6.6	6.8	6.9	7.0	7.4	8.2	10.0	10.4	10.9	11.3	11.3	11.3	11.2	8.8	7.8	8.1	8.3	7.7	7.8	7.4	8.5
Detroit, Mich.	7.8	7.5	7.8	8.1	8.3	7.9	8.0	8.1	7.8	8.9	9.1	9.1	9.4	8.9	9.0	9.1	8.6	7.9	8.0	8.3	8.1	8.0	7.9	8.0	8.3
Dodge City, Kans.	8.8	8.3	9.0	8.9	8.7	8.3	8.2	8.4	8.0	10.0	12.4	12.8	13.6	14.3	14.3	13.8	13.4	12.1	9.4	8.7	9.7	9.0	9.0	9.4	10.3
Dubuque, Iowa.	6.8	6.9	6.8	7.2	7.3	7.2	6.8	6.8	7.4	8.1	8.2	8.9	9.8	10.0	9.7	9.6	8.9	7.5	6.8	6.9	7.0	6.6	6.5	6.3	7.7
Duluth, Minn.	10.9	10.4	10.6	11.3	11.2	11.0	10.6	10.4	9.7	8.9	9.3	9.2	9.8	10.2	10.2	10.8	9.8	8.3	8.6	8.8	9.7	10.3	11.1	11.8	10.1
Eastport, Me.	12.5	12.3	12.5	13.0	13.7	14.3	15.6	16.8	17.0	17.3	17.4	17.7	16.0	15.6	15.7	14.9	14.8	14.8	14.4	14.2	13.4	14.0	13.3	13.5	14.8
El Paso, Tex.	7.9	7.4	7.5	7.2	7.0	7.7	7.3	8.6	7.7	7.8	9.3	10.3	11.0	11.4	13.2	13.3	13.2	12.4	10.7	9.6	9.7	10.5	9.2	8.3	9.5
Erie, Pa.	15.9	16.0	16.0	15.4	15.2	15.0	14.8	14.4	15.2	16.0	15.7	15.6	16.1	15.7	14.5	13.9	13.3	13.2	14.6	15.7	15.5	15.5	16.4	16.0	15.3
Eureka, Cal.	3.5	3.8	3.6	3.6	3.7	3.8	4.4	4.4	4.7	4.4	4.2	4.2	4.7	5.5	6.2	6.5	6.4	6.9	6.2	5.2	4.9	4.4	4.4	4.0	4.7
Fort Canby, Wash.	14.7	15.3	15.2	15.6	16.3	16.3	16.8	17.6	18.1	18.1	18.4	20.0	19.9	18.1	16.6	16.1	15.8	15.3	14.9	14.9	15.0	14.4	14.1	14.9	16.3
Fort Smith, Ark.	6.1	6.6	6.9	7.4	7.7	7.6	7.7	7.7	7.8	8.4	9.4	9.2	9.1	9.5	10.1	9.4	9.3	8.0	6.9	6.5	6.1	5.7	6.0	5.9	7.7
Fresno, Cal.	4.5	4.3	3.9	4.1	3.9	3.9	4.5	4.0	3.8	3.4	3.1	3.4	4.6	5.3	5.4	4.6	4.4	4.2	4.1	4.2	4.2	3.7	3.9	3.9	4.1
Galveston, Tex.	11.3	11.3	11.2	10.7	11.5	10.9	11.5	12.7	13.2	13.2	13.1	13.0	13.0	12.9	12.7	12.6	12.3	11.4	10.6	10.7	11.1	11.2	11.3	10.7	11.8
Grand Haven, Mich.	12.8	12.9	12.6	12.3	11.8	11.7	11.2	11.0	11.9	12.6	13.4	13.5	13.3	13.1	12.7	12.6	12.4	11.5	11.7	12.0	12.2	12.9	12.9	13.2	12.4
Greenbay, Wis.	8.2	8.2	8.1	7.9	8.2	8.4	8.6	8.7	8.7	9.4	9.7	10.0	10.3	10.0	9.4	9.2	9.1	7.7	7.9	8.4	7.7	8.0	7.7	8.2	8.6
Hannibal, Mo.	9.4	8.8	9.2	9.2	9.2	10.2	10.0	9.8	10.0	11.3	12.0	12.1	12.9	13.3	13.1	13.1	11.7	10.4	9.4	9.0	9.2	9.2	9.8	10.4	10.5
Harrisburg, Pa.	7.7	7.7	7.8	7.8	8.3	7.7	8.5	8.4	9.1	9.7	10.1	10.3	10.8	11.7	11.7	10.5	10.1	9.3	9.2	9.4	8.3	8.0	8.7	7.8	9.1
Hatteras, N. C.	15.5	15.3	15.2	15.7	15.8	15.7	15.6	14.8	15.0	15.4	15.8	15.9	15.9	16.2	16.3	15.9	15.0	14.8	15.3	15.4	15.4	14.6	14.8	14.6	15.4
Havre, Mont.	9.3	8.4	9.3	9.0	9.0	8.8	8.7	9.4	8.8	8.4	8.2	8.7	10.3	11.0	11.6	11.0	11.2	10.3	9.3	8.7	8.6	8.4	9.0	9.2	9.4
Helena, Mont.	6.5	6.2	5.9	6.1	5.8	5.1	6.3	6.2	6.0	5.7	5.4	5.9	6.2	5.8	6.0	6.0	6.5	6.1	6.4	6.7	7.0	7.1	6.2	6.2	6.1
Huron, S. Dak.	11.4	11.0	11.0	11.0	10.6	10.4	10.1	9.3	9.8	10.6	11.8	11.9	12.2	13.1	13.8	14.2	13.7	11.8	11.0	11.0	11.2	12.0	11.8	11.8	11.5
Idaho Falls, Idaho.	11.9	12.4	12.4	12.4	11.2	11.2	12.2	11.9	11.3	10.5	10.2	11.8	14.0	14.3	14.8	15.1	15.0	14.0	12.2	11.2	12.0	13.3	13.0	13.1	12.6
Indianapolis, Ind.	11.8	11.9	11.6	11.5	11.5	12.1	11.6	11.4	12.2	12.9	14.0	13.6	13.2	13.4	13.5	13.2	12.4	11.9	11.7	12.0	12.2	12.5	12.2	11.9	12.3
Jacksonville, Fla.	5.3	5.7	5.9	6.1	6.3	6.4	6.2	6.6	7.3	7.9	9.0	9.3	9.7	9.4	9.8	9.7	8.9	7.1	6.4	5.7	5.5	5.5	5.3	5.3	7.1
Jupiter, Fla.	10.8	10.4	10.6	11.0	10.9	10.7	10.6	10.2	10.3	11.8	12.3	12.2	12.7	12.3	11.8	12.2	11.3	11.4	11.1	12.0	12.2	12.5	12.2	11.2	11.3
Kansas City, Mo.	9.2	9.9	9.3	8.8	9.0	9.0	9.1	8.7	9.0	9.5	10.6	11.0	11.7	11.4	11.3	11.1	10.6	9.8	9.6	9.5	9.6	9.2	9.8	9.2	9.8
Keokuk, Iowa.	7.9	7.1	7.5	7.5	7.3	7.9	8.1	8.6	8.7	9.4	9.6	10.1	10.7	10.4	11.3	10.7	10.2	8.6	7.8	7.7	7.3	7.9	7.7	7.5	8.7
Key West, Fla.	12.3	12.4	12.5	12.3	12.7	12.9	12.7	12.3	13.1	13.5	13.8	14.0	14.6	14.0	13.5	13.5	13.4	12.8	12.1	13.0	12.9	13.0	13.2	12.7	13.0
Kittyhawk, N. C.	16.0	17.2	17.3	16.4	15.9	16.0	15.8	15.9	16.3	15.9	15.9	16.5	18.2	17.5	17.0	17.3	16.6	16.1	15.3	15.0	15.0	15.8	16.1	15.8	16.3
Knoxville, Tenn.	7.2	7.6	7.2	6.6	6.5	6.2	7.1	6.4	6.5	7.8	8.9	9.0	10.4	11.4	12.1	11.3	10.5	9.1	8.1	7.2	6.6	6.2	6.6	6.7	8.1
La Crosse, Wis.	8.2	8.0	8.4	8.1	7.5	7.5	7.5	7.4	7.4	7.4	8.1	8.2	9.0	8.9	8.5	8.7	8.4	7.5	6.7	6.4	6.5	7.0	7.0	7.6	7.7
Lander, Wyo.	3.1	3.3	3.4	3.6	3.6	3.3	3.4	3.5	3.2	3.3	3.7	4.4	5.6	5.5	5.8	6.3	6.5	6.5	5.0	4.5	4.4	4.8	4.3	3.8	4.4
Lexington, Ky.	12.5	12.5	12.5	13.3	12.9	12.8	13.1	13.0	14.7	16.0	16.3	15.3	15.5	15.1	13.6	13.6	12.3	11.5	11.5	11.9	11.7	12.4	12.5	12.0	13.3
Little Rock, Ark.	7.2	6.6	6.8	6.9	7.2	7.4	6.9	6.7	7.8	9.3	10.3	10.9	11.6	11.0	11.2	10.0	9.1	7.5	6.7	6.7	6.7	7.0	6.6	6.8	8.1
Los Angeles, Cal.	2.3	2.7	3.0	3.3	3.2	3.5	3.1	3.3	3.5	3.3	3.5	3.8	3.5	3.5	4.3	5.1	5.8	6.5	6.5	5.0	3.4	2.0	2.2	2.0	3.7
Louisville, Ky.	8.3	9.0	8.9	9.1	8.6	9.0	9.5	9.4	9.9	10.7	11.5	11.4	11.4	10.9	10.2	9.6	10.0	9.0	7.9	8.6	8.2	8.5	8.3	8.4	9.4
Lynchburg, Va.	3.2	2.9	3.0	2.8	3.1	3.6	3.3	3.6	4.2	5.8	6.4	6.9	7.5	6.9	7.0	6.4	5.9	4.6	4.1	4.3	4.2	3.9	3.4	2.9	4.6
Marquette, Mich.	10.0	10.6	10.5	10.5	10.1	10.6	10.3	11.1	11.5	12.3	13.1	13.5	12.6	12.5	12.4	11.3	10.0	9.3	8.8	9.0	9.5	9.9	10.9	10.1	10.9
Memphis, Tenn.	11.6	12.4	12.0	11.4	11.5	11.4	11.2	11.8	12.0	12.5	12.8	12.7	12.9	12.7	12.5	11.8	11.6	10.9	9.3	9.9	10.9	11.0	11.3	11.5	11.7
Milwaukee, Wis.	11.1	10.8	10.6	10.1	10.4	10.5	10.6	10.6	11.4	11.7	12.2	12.1	12.4	12.4	12.1	12.2	11.8	10.6	10.6	11.0	10.8	10.7	11.0	11.0	11.2
Mobile, Ala.	5.9	5.5	6.1	5.8	6.1	5.9	5.8	6.1	5.9	6.8	6.9	7.7	8.8	9.0	9.1	9.2	8.6	7.7	6.7	6.8	6.9	6.5	6.7	6.0	6.9
Montgomery, Ala.	6.1	6.0	5.3	4.4	5.2	5.3	5.4	5.0	5.5	6.7	7.9	8.4	8.6	8.8	8.8	8.3	7.8	6.3	5.8	6.3	6.7	6.6	6.2	6.0	6.6
Moorhead, Minn.	8.5	8.8	8.4	8.3	8.4	8.0	8.1	8.5	8.3	8.0	8.8	8.8	9.3	9.4	10.0	9.9	10.0	9.0	8.2	8.4	8.7	8.2	8.7	8.7	8.7
Nantucket, Mass.	15.1	15.5	14.8	14.5	13.9	13.7	13.9	13.9	14.3	15.0	15.0	15.1	14.8	14.5	13.7	12.6	11.6	11.9	12.3	12.8	13.3	14.0	14.5	14.7	14.0
Nashville, Tenn.	7.9	7.4	7.8	7.2	7.2	6.3	6.7	6.7	6.6	8.8	9.7	9.9	10.4	10.5	10.9	10.4	9.8	8.4	7.7	7.8	7.7	8.1	7.8	8.0	8.3
New Haven, Conn.	9.4	8.9	9.0	8.3	7.9	7.6	7.5	7.9	9.3	10.7	11.7	11.9	13.2	13.3	12.3	11.8	10.8	10.3	10.7	10.2	9.7	10.1	9.7	9.4	10.1
New Orleans, La.	8.0	7.5	7.8	7.7	7.4	7.8	7.8	7.8	7.7	8.7	9.6	10.1	10.1	10.2	10.8	10.8	10.7	9.5	9.0	8.5	8.0	8.0	8.0	8.0	8.7
New York, N. Y.	14.4	14.4	12.6	12.9	12.9	11.9	12.1	11.9	13.0	14.8	15.8	16.2	17.2	17.3	17.7	17.9	17.6	17.4	17.3	16.7	16.6	15.3	14.6	13.6	15.1
Norfolk, Va.	8.8	8.8	8.4	8.1	8.2	7.7	8.1	7.8	8.5	9.8	10.2	11.6	12.0	11.9	12.1	11.1	9.7	8.6	8.6	8.6	8.6	8.5	8.2	8.6	9.3
Northfield, Vt.	9.0	7.9	8.1	8.3	8.0	8.6	8.9	9.2	9.5	9.6	10.9	11.0	10.9	11.6	11.6	11.2	10.1	9.5	9.5	10.1	10.3	10.4	9.1	9.1	9.7
North Platte, Nebr.	7.4	7.6	7.3	7.1	7.4	6.9	7.2	6.6	6.3	6.9	8.5	8.0	8.7	9.5	10.3	10.9	10.1	9.0	8.3	7.7	7.0	7.8	8.3	8.0	8.0
Oklahoma, Okla.	12.0	12.2	12.2	11.7	12.3	12.0	12.0	11.7	11.7	13.4	14.8	15.4	15.2	15.5	15.5	15.0	14.8	12.6	10.4	10.7	11.4	11.7	11.5	11.5	12.8
Omaha, Nebr.	7.2	7.5	7.4	7.5	7.5	7.3	7.2	7.4	7.9	8.4	8.7	9.1	9.7	9.4	9.4	9.3	9.0	8.4	7.5	7.8	8.0	7.7	7.5	7.4	8.1
Oswego, N. Y.	14.6	14.8	15.5	16.0	15.0	15.2	15.4	14.8	14.8	15.6	16.0	15.9	15.9	15.5	15.5	15.1	15.0	14.4	14.4	14.2	14.6	14.7	14.2	13.9	15.0
Palestine, Tex.	6.9	6.8	6.4	6.1	6.3	6.2	6.5	6.8	6.8	7.8	9.5	9.5	9.3	9.7	9.2	9.2	8.5	7.6	5.5	5.0	5.8	6.2	6.5	6.8	7.3
Parkersburg, W. Va.	4.6	4.4	4.7	5.1	4.8	4.9	4.7	4.9	5.0	5.6	6.5	7.1	7.3	6.8	6.8	6.0	5.6	4.7	4.2	4.2	4.3	4.7	4.8	4.9	5.3

TABLE VII.—*Average wind movement, etc.*—Continued.

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Pensacola, Fla.	9.2	9.4	8.9	9.0	9.0	8.7	8.8	8.8	8.4	9.1	9.1	9.4	9.5	10.2	10.1	10.2	10.7	9.7	8.5	7.5	7.2	7.4	8.3	8.6	9.0
Philadelphia, Pa.	8.6	8.2	8.0	7.7	7.2	7.2	7.2	7.5	8.9	10.4	11.7	12.2	13.6	13.4	13.2	12.0	11.3	10.2	10.3	9.8	9.4	8.4	8.5	8.3	9.7
Phœnix, Ariz	2.9	3.0	3.1	3.3	3.1	3.1	3.4	3.4	3.5	3.0	2.7	2.9	3.5	4.3	4.7	4.5	4.3	3.6	3.2	2.7	2.4	1.9	2.3	2.7	3.2
Pierre, S. Dak.	6.0	6.0	5.4	5.7	5.4	5.0	5.7	6.3	6.9	7.1	7.6	8.5	9.8	10.7	11.0	11.3	10.6	10.1	9.0	7.7	7.1	6.7	5.9	5.7	7.6
Pittsburg, Pa.	7.3	7.4	7.1	7.0	6.9	6.9	6.6	7.6	8.2	8.0	8.7	9.5	9.4	9.8	9.8	8.8	7.9	7.5	7.2	7.0	6.9	6.6	6.4	7.1	7.7
Port Angeles, Wash.	5.1	5.6	5.6	6.0	6.1	5.7	5.8	5.8	6.0	6.0	6.4	5.7	5.0	4.7	4.7	5.6	6.2	5.8	5.4	5.8	5.4	5.0	5.2	5.3	5.6
Port Huron, Mich.	13.1	12.7	12.7	12.6	12.4	13.1	12.9	13.2	12.7	13.9	14.6	14.5	15.4	15.0	14.7	14.9	13.5	12.4	12.2	12.9	13.6	13.4	13.1	13.4	13.5
Portland, Me.	7.0	7.5	7.5	7.2	7.0	6.9	6.6	7.0	7.5	8.6	9.6	9.4	9.6	9.5	9.5	9.0	7.9	7.6	7.3	7.4	7.4	7.6	7.1	6.9	7.9
Portland, Oreg.	11.4	11.4	10.8	10.5	9.4	9.5	8.7	8.2	8.0	8.6	8.4	8.5	10.1	10.5	11.0	11.5	11.6	10.4	9.9	9.2	9.8	10.2	9.8	10.3	9.9
Pueblo, Colo.	5.6	5.4	5.6	5.9	5.6	5.6	5.9	6.4	6.7	7.0	7.3	7.6	7.3	7.9	8.3	8.8	9.2	8.5	8.1	6.8	5.7	6.0	5.6	6.0	6.8
Raleigh, N. C.	6.1	5.8	5.7	5.3	5.2	5.6	5.6	5.8	6.8	8.5	9.1	9.3	9.4	9.5	9.3	8.7	6.5	4.8	5.1	5.2	5.7	5.2	5.5	6.2	6.7
Rapid City, S. Dak.	5.4	5.9	6.8	8.1	7.6	7.7	7.3	6.8	6.8	6.4	6.5	6.3	7.1	8.3	9.1	9.0	8.0	6.7	5.2	5.2	5.2	5.5	5.6	6.2	6.8
Redbluff, Cal.	3.2	2.9	3.3	3.9	3.7	4.0	3.8	3.5	3.7	4.1	4.6	4.3	5.1	5.2	5.0	5.1	4.8	4.6	4.5	3.8	3.8	4.0	3.7	3.5	4.1
Rochester, N. Y.	9.1	9.6	9.5	9.7	9.3	9.2	9.3	8.9	9.1	9.8	10.4	10.4	10.7	10.2	10.1	9.5	8.8	8.3	8.1	8.1	8.6	8.8	8.7	9.0	9.3
Roseburg, Oreg.	2.6	2.2	2.1	2.2	2.2	1.9	2.0	2.6	3.0	2.5	2.8	3.1	2.7	3.7	3.9	4.3	4.6	4.7	4.3	3.1	2.9	2.6	2.4	2.6	3.0
Sacramento, Cal.	5.9	6.6	5.9	5.8	6.2	6.0	6.1	6.3	5.7	5.5	5.6	5.9	6.5	6.5	6.8	7.2	7.1	6.7	6.1	5.2	5.3	5.8	6.3	6.4	6.1
St. Louis, Mo.	10.8	10.9	10.3	10.4	9.8	9.9	10.3	11.2	11.1	10.8	11.1	11.2	11.1	11.1	11.2	11.1	11.0	10.2	9.8	10.2	10.8	10.8	11.0	10.4	10.7
St. Paul, Minn.	6.8	6.7	6.7	7.0	7.0	7.2	6.6	6.4	7.0	7.7	7.6	7.6	8.3	8.5	8.5	8.7	7.9	7.2	6.5	6.4	6.8	6.6	6.2	6.7	7.2
Salt Lake City, Utah.	4.7	4.4	5.3	4.8	4.4	4.2	4.5	4.8	4.7	5.1	4.4	4.0	5.3	5.7	6.5	7.0	6.7	5.8	4.8	4.0	4.1	4.2	4.5	4.6	4.9
San Antonio, Tex.	6.9	6.5	7.4	7.5	7.7	8.1	8.3	8.3	8.9	9.8	10.2	10.3	10.3	11.2	11.1	10.5	10.3	9.9	8.8	8.1	8.4	8.8	8.3	7.9	8.9
San Diego, Cal.	3.2	3.6	3.8	3.9	3.9	4.7	3.7	4.2	4.2	4.2	2.9	2.6	3.9	6.1	8.4	9.7	10.1	9.7	8.7	6.3	4.3	2.8	3.4	3.4	5.1
Sandusky, Ohio	10.1	9.6	10.3	10.5	9.9	10.4	10.1	9.7	10.5	11.3	11.9	12.5	12.6	12.3	12.6	12.0	11.2	10.2	10.5	10.2	10.7	11.0	10.7	11.0	10.9
San Francisco, Cal.	7.3	6.8	6.3	6.5	6.4	6.4	6.4	6.5	6.4	5.5	5.9	5.6	6.7	7.2	7.4	7.5	8.4	9.1	9.9	10.7	9.7	9.1	8.1	7.2	7.4
San Luis Obispo, Cal.	3.6	3.7	4.0	3.9	4.3	4.2	4.1	4.2	3.9	3.9	4.3	4.7	5.2	5.6	6.2	7.1	8.0	8.2	7.0	6.3	5.0	3.9	2.8	3.1	4.9
Santa Fe, N. Mex.	3.8	3.6	3.5	4.2	4.2	3.7	4.1	4.1	4.6	4.9	5.9	7.7	9.2	9.0	8.8	8.9	7.8	7.0	5.0	2.9	3.7	4.2	4.2	3.8	5.4
Sault Ste Marie, Mich.	10.5	10.4	10.6	10.0	10.8	11.6	10.9	11.0	11.6	11.2	11.2	11.1	11.8	12.9	13.6	13.3	13.7	13.2	12.3	11.9	12.3	11.8	11.3	11.2	11.7
Savannah, Ga.	6.9	7.1	7.2	7.1	7.1	6.7	6.7	6.9	7.4	8.9	9.0	9.9	10.2	10.0	10.1	9.3	9.0	7.0	7.6	7.7	7.9	8.2	8.0	7.3	8.0
Seattle, Wash.	7.7	7.5	7.3	7.0	6.8	6.1	6.2	6.4	6.1	6.3	6.3	6.0	6.0	6.9	6.9	7.8	8.2	7.3	7.4	6.8	6.7	7.3	7.0	7.0	6.9
Shreveport, La.	7.9	7.1	7.2	7.4	7.5	7.4	7.1	7.0	6.7	7.8	9.4	9.5	9.2	9.0	9.1	9.7	9.5	7.8	6.6	7.0	7.2	7.4	7.7	8.0	7.9
Sioux City, Iowa	11.6	11.8	11.2	11.6	11.4	11.2	11.1	11.1	11.1	11.2	12.0	12.0	13.9	14.6	15.7	16.0	16.0	14.9	13.4	13.3	12.8	12.0	11.8	11.3	12.6
Spokane, Wash.	6.2	6.1	6.1	5.5	5.1	5.0	4.7	4.8	4.8	4.2	4.3	4.8	5.5	6.2	6.5	7.3	7.3	7.5	7.8	7.2	6.6	7.5	7.6	6.7	6.1
Springfield, Ill.	10.8	10.4	9.9	10.3	9.9	9.5	9.6	10.2	10.7	11.4	11.9	11.9	12.2	12.9	12.8	12.5	12.6	11.3	10.4	10.8	10.7	10.9	10.6	10.6	11.0
Springfield, Mo.	12.6	12.6	12.0	12.1	12.1	12.1	12.1	12.3	12.0	13.3	14.0	14.8	14.8	14.1	13.9	13.7	13.3	11.9	11.5	11.2	11.3	11.7	11.9	12.0	12.6
Tacoma, Wash.	7.7	7.3	7.4	7.3	6.5	6.2	6.4	6.6	5.7	5.3	5.8	5.7	5.6	7.0	7.7	8.8	9.1	8.6	8.0	7.4	7.5	7.7	7.2	7.1	7.1
Tampa, Fla.	4.5	4.8	5.0	5.4	5.0	5.3	6.1	6.1	6.4	7.9	8.5	8.7	9.1	9.0	8.6	8.3	7.7	5.8	5.6	5.6	5.1	4.9	4.8	4.0	6.3
Tatoosh Island, Wash.	14.6	15.3	15.9	16.7	16.6	15.9	16.2	16.1	15.5	15.6	15.7	15.1	13.5	14.5	13.0	12.9	13.1	13.6	13.8	14.6	14.3	14.3	14.8	14.5	14.8
Toledo, Ohio	10.7	11.0	11.4	10.8	10.3	9.9	9.9	10.4	11.4	12.0	13.2	12.9	13.7	13.4	13.8	12.5	11.9	10.5	10.5	10.4	11.1	11.2	10.9	10.7	11.4
Vicksburg, Miss.	8.0	7.8	7.4	7.7	7.7	7.2	7.1	7.4	7.1	8.1	8.6	8.4	8.5	8.0	7.9	7.9	7.0	6.3	6.1	6.7	7.2	7.8	7.6	7.6	7.5
Vineyard Haven, Mass	12.0	11.5	10.9	10.9	10.8	10.4	10.6	10.4	10.9	11.4	12.0	11.8	11.6	11.4	11.3	10.3	10.0	9.7	10.3	10.2	10.4	10.9	11.7	12.1	11.0
Walla Walla, Wash.	5.9	6.1	5.9	5.6	5.5	6.0	5.9	6.1	6.0	5.4	5.9	6.5	7.7	8.4	8.8	8.9	8.4	7.6	6.4	5.2	5.4	5.8	6.7	6.7	6.5
Washington, D. C.	5.8	5.5	5.0	4.6	4.9	5.3	5.7	5.9	8.2	9.8	9.5	10.1	9.6	10.8	10.6	10.1	8.2	6.5	6.3	7.1	6.9	5.9	5.8	5.6	7.2
Wichita, Kans.	9.6	9.8	9.5	9.5	9.4	9.5	9.2	9.0	8.9	10.0	11.5	12.3	12.3	12.0	12.5	12.7	12.2	11.3	9.8	9.7	10.2	9.4	9.8	10.0	10.4
Williston, N. Dak.	6.8	7.2	6.5	7.1	7.5	7.2	7.6	8.0	7.2	6.7	6.6	7.6	9.2	10.0	10.3	10.0	10.5	9.6	7.5	6.4	6.7	7.4	6.5	6.6	7.8
Wilmington, N. C.	7.7	8.1	7.8	7.2	6.8	6.9	7.3	7.5	8.3	8.9	10.4	11.3	11.8	11.7	11.3	11.2	8.9	7.4	7.9	7.6	7.3	7.8	7.4	7.1	8.6
Woods Hole, Mass.	21.2	20.1	20.1	20.1	20.0	20.0	19.2	18.9	18.8	19.6	19.1	17.3	18.5	18.4	19.1	18.7	18.4	18.0	18.5	17.6	18.5	18.6	20.1	20.3	19.1
Yankton, S. Dak.	6.8	7.2	7.1	7.2	6.9	7.2	7.3	7.6	7.4	7.3	8.2	9.7	11.1	11.8	11.9	11.8	10.8	9.0	7.9	7.8	8.3	7.8	7.7	6.9	8.4

TABLE VIII.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of November, 1897.*

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
New England.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Eastport, Me	20	13	10	31	n. 72 w.	22
Portland, Me	25	12	3	26	n. 61 w.	26
Northfield, Vt	27	27	4	8	w.	4
Boston, Mass	16	13	5	36	n. 84 w.	31
Nantucket, Mass	25	21	6	23	n. 77 w.	18
Woods Hole, Mass.*	5	10	7	15	s. 58 w.	9
Block Island, R. I	22	16	13	29	n. 69 w.	17
New Haven, Conn	27	7	12	27	n. 37 w.	25
Middle Atlantic States.						
Albany, N. Y	18	22	7	21	s. 74 w.	15
Binghamton, N. Y.†	10	8	2	14	n. 81 w.	12
New York, N. Y	20	16	13	28	n. 75 w.	16
Harrisburg, Pa	9	13	21	27	s. 56 w.	7
Philadelphia, Pa	20	18	12	25	n. 81 w.	13
Atlantic City, N. J	17	18	4	34	s. 88 w.	30
Baltimore, Md	15	14	16	29	n. 86 w.	13
Washington, D. C	19	19	9	23	w.	14
Lynchburg, Va	16	23	8	31	s. 73 w.	24
Norfolk, Va	21	22	14	19	s. 79 w.	5
South Atlantic States.						
Charlotte, N. C	14	26	19	13	s. 27 e.	13
Hatteras, N. C	26	18	7	23	n. 63 w.	18
Kittyhawk, N. C.						
Raleigh, N. C	21	21	10	30	w.	10
Wilmington, N. C	20	23	9	21	s. 76 w.	12
Charleston, S. C	19	20	14	19	s. 79 w.	5
Augusta, Ga	18	18	10	26	w.	16
Savannah, Ga	20	23	12	18	s. 63 w.	7
Jacksonville, Fla	23	11	19	19	n.	12
Florida Peninsula.						
Jupiter, Fla	19	5	30	15	n. 65 e.	33
Key West, Fla	33	1	42	2	n. 51 e.	51
Tampa, Fla	36	5	17	13	n. 7 e.	31
Eastern Gulf States.						
Atlanta, Ga	19	16	15	25	n. 73 w.	10
Pensacola, Fla	26	13	24	11	n. 45 e.	18
Mobile, Ala	30	17	14	14	n.	13
Montgomery, Ala	22	15	20	14	n. 41 e.	9
Vicksburg, Miss	16	34	26	10	s. 42 e.	24
New Orleans, La	22	18	27	5	n. 80 e.	22
Western Gulf States.						
Shreveport, La	19	25	22	13	s. 56 e.	11
Fort Smith, Ark	13	11	30	14	n. 83 e.	16
Little Rock, Ark	19	27	13	17	s. 27 w.	9
Corpus Christi, Tex	32	15	24	5	n. 48 e.	29
Galveston, Tex	22	20	23	6	n. 83 e.	17
Palestine, Tex	27	24	13	7	n. 63 e.	7
San Antonio, Tex	28	17	22	6	n. 56 e.	19
Ohio Valley and Tennessee.						
Chattanooga, Tenn	16	28	9	19	s. 40 w.	16
Knoxville, Tenn	20	27	10	21	s. 58 w.	13
Memphis, Tenn	15	26	16	13	s. 15 e.	11
Nashville, Tenn	15	25	14	18	s. 22 w.	11
Lexington, Ky	11	27	13	19	s. 21 w.	17
Louisville, Ky	14	30	14	14	s.	16
Indianapolis, Ind	20	18	7	19	n. 81 w.	12
Cincinnati, Ohio	15	24	17	20	s. 18 w.	10
Columbus, Ohio	12	24	13	26	s. 47 w.	18
Pittsburg, Pa	2	31	8	27	s. 33 w.	35
Parkersburg, W. Va	12	25	14	21	s. 28 w.	15
Lower Lake Region.						
Buffalo, N. Y	12	21	8	30	s. 68 w.	24
Oswego, N. Y	16	29	11	20	s. 35 w.	16
Rochester, N. Y	10	27	8	30	s. 52 w.	28
Erie, Pa	17	29	6	22	s. 53 w.	20
Cleveland, Ohio	15	30	8	20	s. 39 w.	19
Sandusky, Ohio	17	24	4	29	s. 74 w.	26
Toledo, Ohio	11	22	8	31	s. 64 w.	26
Detroit, Mich	9	23	7	29	s. 58 w.	26
Upper Lake Region.						
Alpena, Mich	17	19	6	31	s. 85 w.	25
Grand Haven, Mich	25	17	17	19	n. 14 w.	8
Marquette, Mich	23	13	7	30	n. 67 w.	25
Port Huron, Mich	10	27	11	25	s. 39 w.	22
Sault Ste. Marie, Mich	19	11	22	20	n. 14 e.	8
Chicago, Ill	19	24	8	20	s. 67 w.	13
Milwaukee, Wis	19	20	7	25	s. 87 w.	18

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
Upper Lake Region—Cont'd.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Greenbay, Wis	17	22	5	25	s. 76 w.	21
Duluth, Minn	30	9	10	32	n. 64 w.	25
North Dakota.						
Moorhead, Minn	25	17	19	13	n. 37 e.	10
Bismarck, N. Dak	27	8	17	23	n. 18 w.	20
Williston, N. Dak	30	11	7	18	n. 30 w.	22
Upper Mississippi Valley.						
St. Paul, Minn	22	17	11	23	n. 67 w.	13
La Crosse, Wis.†	14	12	6	6	n.	2
Davenport, Iowa	17	16	15	23	n. 83 w.	8
Des Moines, Iowa	22	17	17	20	n. 31 w.	6
Dubuque, Iowa	18	24	11	22	s. 61 w.	12
Keokuk, Iowa	20	23	10	24	s. 78 w.	14
Cairo, Ill	17	28	9	11	s. 10 w.	11
Springfield, Ill	18	28	7	18	s. 48 w.	15
Hannibal, Mo.†	10	9	6	12	n. 80 w.	6
St. Louis, Mo	16	27	8	15	s. 32 w.	13
Missouri Valley.						
Columbia, Mo.*	8	11	6	9	s. 45 w.	4
Kansas City, Mo	19	24	13	18	s. 45 w.	7
Springfield, Mo	17	30	16	10	s. 25 e.	14
Lincoln, Nebr	25	21	13	13	n.	4
Omaha, Nebr	23	22	10	15	n. 79 w.	5
Sioux City, Iowa†	13	11	8	5	n. 56 e.	4
Pierre, S. Dak	23	18	20	15	n. 45 e.	7
Huron, S. Dak	24	19	15	15	n.	5
Yankton, S. Dak†	9	10	6	10	s. 76 w.	4
Northern Slope.						
Havre, Mont	22	14	17	24	n. 41 w.	11
Miles City, Mont	24	20	12	16	n. 45 w.	6
Helena, Mont	17	26	2	34	s. 74 w.	33
Rapid City, S. Dak	25	6	13	29	n. 40 w.	25
Cheyenne, Wyo	20	14	3	35	n. 79 w.	33
Lander, Wyo	12	29	18	20	s. 7 w	17
North Platte, Nebr	17	15	13	28	n. 82 w.	15
Middle Slope.						
Denver, Colo	16	33	10	10	s.	17
Pueblo, Colo	15	11	18	27	n. 66 w.	10
Concordia, Kans	20	27	9	11	s. 16 w.	7
Dodge City, Kans	21	23	8	19	s. 80 w.	11
Wichita, Kans	22	31	8	8	s.	9
Oklahoma, Okla	22	31	7	9	s. 13 w.	9
Southern Slope.						
Abilene, Tex	18	32	9	13	s. 16 w.	15
Amarillo, Tex	14	32	2	16	s. 38 w.	23
Southern Plateau.						
El Paso, Tex	20	5	23	26	n. 11 w.	15
Santa Fe, N. Mex	19	20	19	11	s. 84 e.	9
Phœnix, Ariz	17	8	33	16	n. 62 e.	19
Yuma, Ariz	38	4	16	12	n. 7 e.	34
Middle Plateau.						
Carson City, Nev	15	20	7	28	s. 77 w.	22
Winnemucca, Nev	17	13	9	22	n. 73 w.	14
Salt Lake City, Utah	17	21	7	20	s. 73 w.	14
Northern Plateau.						
Baker City, Oreg	16	28	11	19	s. 34 w.	14
Idaho Falls, Idaho	10	43	4	6	s. 3 w.	33
Spokane, Wash	15	28	15	18	s. 13 w.	13
Walla Walla, Wash	3	43	7	11	s. 6 w.	40
North Pacific Coast Region.						
Fort Canby, Wash	12	16	25	16	s. 66 e.	10
Port Angeles, Wash.*	2	10	9	15	s. 37 w.	10
Seattle, Wash	12	32	23	2	s. 46 e.	29
Tacoma, Wash	10	36	15	16	s. 2 w.	29
Tatoosh Island, Wash	8	21	19	30	s. 4 w.	13
Portland, Oreg	10	30	15	17	s. 6 w.	29
Roseburg, Oreg	11	30	12	17	s. 15 w.	29
Middle Pacific Coast Region.						
Eureka, Cal	16	22	22	17	s. 40 e.	8
Redbluff, Cal	33	9	11	18	n. 16 w.	25
Sacramento, Cal	24	22	19	13	n. 72 e.	6
San Francisco, Cal	23	8	2	36	n. 66 w.	37
South Pacific Coast Region.						
Fresno, Cal	30	7	10	33	n. 45 w.	32
Los Angeles, Cal	26	1	16	28	n. 26 w.	28
San Diego, Cal	36	2	17	20	n. 5 w.	34
San Luis Obispo, Cal	42	6	3	16	n. 5 w.	36

*From observations at 8 p. m. only. †From observations at 8 a. m. only.

TABLE IX.—*Thunderstorms and auroras, November, 1897.*

States.	No. of stations.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total. No.	Total. Days.	
Alabama	52	T.																																0	0	T.
		A.																																0	0	A.
Arizona	52	T.																																0	0	T.
		A.																																0	0	A.
Arkansas	61	T.				4	3			1						2	11	7																0	0	T.
		A.																																0	0	A.
California	181	T.						3	1																	4	4							36	8	T.
		A.																					4									3		0	0	A.
Colorado	75	T.							2																									11	4	T.
		A.																																0	0	A.
Connecticut	14	T.									4																							2	1	T.
		A.																																0	0	A.
Delaware	3	T.	1																								1			1				5	2	T.
		A.																																1	1	A.
Dist. of Columbia	4	T.																																1	1	T.
		A.																																0	0	A.
Florida	45	T.	2																															0	0	T.
		A.																																2	1	A.
Georgia	62	T.	1																															0	0	T.
		A.																																5	3	A.
Idaho	30	T.																									2		2					0	0	T.
		A.																																0	0	A.
Illinois	92	T.	1				1	2	6	15	1				1	15	10	6								1	5	18				1		83	14	T.
		A.														1																		1	1	A.
Indiana	54	T.							9	8	1				1	9	4	3	2								1	11						49	10	T.
		A.																								1	1							2	2	A.
Indian Territory	7	T.														1																		1	1	T.
		A.																																0	0	A.
Iowa	122	T.														9																		9	1	T.
		A.		1																														1	1	A.
Kansas	85	T.							2	1						1	1										2							7	5	T.
		A.		1	1														1	1	1							1						5	5	A.
Kentucky	52	T.	4		1		1			2						1		4																14	7	T.
		A.																																0	0	A.
Louisiana	50	T.								2	1																							10	4	T.
		A.																																0	0	A.
Maine	14	T.									2																							2	1	T.
		A.														1			1							1	1							4	1	A.
Maryland	35	T.		1						2		1						1										2	1					8	6	T.
		A.									4																	1						1	1	A.
Massachusetts	24	T.																																4	1	T.
		A.								2						1					1													4	1	A.
Michigan	112	T.																																5	4	T.
		A.		1														1										1						5	2	A.
Minnesota	69	T.																																2	0	T.
		A.																2					1			1								2	0	A.
Mississippi	46	T.							1																		4		1					8	4	T.
		A.				1	2	2	12	8						11	9	2								2	3	6				1		59	12	T.
Missouri	95	T.			1	1																												2	2	T.
		A.						1										1	1			1		1					1					6	2	A.
Montana	37	T.														1																		3	2	T.
		A.												2																				0	0	A.
Nebraska	143	T.																																3	2	T.
		A.																																0	0	A.
Nevada	48	T.																																3	2	T.
		A.																																7	5	A.
New Hampshire	14	T.																																0	0	T.
		A.																																5	3	A.
New Jersey	55	T.																																11	4	T.
		A.																																0	0	A.
New Mexico	39	T.																																19	4	T.
		A.																																3	3	A.
New York	103	T.		3						2	11		3																					6	2	T.
		A.		1										1					1															3	2	A.
North Carolina	59	T.											4																					6	2	T.
		A.																																0	0	A.
North Dakota	46	T.													1																			1	1	T.
		A.	1			1	1														1													8	1	A.
Ohio	135	T.	6	4				2	13	13		2			7	3	3		1	1		1		1	1			1						56	12	T.
		A.			1		1											1									1							6	5	A.
Oklahoma	23	T.			1										2											1				2			3	2	T.
		A.				2	3	1						1	1			1																9	6	A.
Oregon	62	T.																																0	0	T.
		A.																																32	6	A.
Pennsylvania	105	T.		12	1				3	9		6			1																			1	1	T.
		A.																1																1	1	A.
Rhode Island	5	T.								1																								0	0	T.
		A.																																4	2	A.
South Carolina	43	T.	2																								2							4	2	T.
		A.																																0	0	A.
South Dakota	44	T.														1	1	1																3	2	T.
		A.															1	5									4							18	7	A.
Tennessee	65	T.					1			5	1		1																					0	0	T.
		A.													1		1	2																5	4	A.
Texas	85	T.								1																								0	0	T.
		A.																																5	4	A.
Utah	41	T.																								2								0	0	T.
		A.																																2	1	A.
Vermont	13	T.																																0	0	T.
		A.																																0	0	A.
Virginia	49	T.		1								1												1										1	1	T.
		A.																																2	2	A.
Washington	50	T.				5												1	1		1													0	0	T.
		A.																																8	4	A.
West Virginia	35	T.	1	2						1		1																						0	0	T.
		A.																																5	4	A.
Wisconsin	61	T.																																0	0	T.
		A.			1											1																		1	1	A.
Wyoming	14	T.						1																				1						2	1	T.
		A.																																1	0	A.
Sums	2,810	T.	18	23	2	6	15	10	38	64	59	0	19	2	5	62	41	37	4	1	2	1	0	4	0	6	15	58	1	7	5	5	....	511	....	T.
		A.	1	4	3	3	1	2	0	1	1	0	0	1	0	3	3	8	1	2	3	2	2	2	3	8	2	2	2	2	0	2	...	63	....	A.

TABLE X.—*Hourly sunshine as deduced from sunshine recorders, November, 1897.*

Stations.	Instrument.	Percentages for each hour of local mean time ending with the respective hour.																Hours of sunshine.			
		A. M.								P. M.								Total.			Personal estimate.
		5	6	7	8	9	10	11	Noon	1	2	3	4	5	6	7	8	Actual.	Possible.	Percent of possible.	
																		Hours.	*Hours.*		
Albany, N. Y	T.	.....	.....	5	7	21	43	50	47	40	41	45	30	19	.....	.....	.....	101.3	292.3	35	22
Atlanta, Ga	T.	.....	.....	59	60	57	58	71	73	70	65	61	62	64	67	.....	.....	199.3	312.2	64	65
Atlantic City, N. J	P.	.....	.....	44	54	54	65	63	68	66	58	58	58	51	.....	.....	.....	178.4	301.5	59	44
Baltimore, Md	T.	.....	.....	28	35	55	64	67	75	70	64	55	43	29	.....	.....	.....	166.8	301.5	55	48
Binghamton, N. Y	T.	.....	.....	17	23	32	33	37	41	42	41	35	22	13	.....	.....	.....	95.2	294.9	32	24
Bismarck, N. Dak	P.	.....	.....	53	40	46	56	62	70	70	67	68	67	70	.....	.....	.....	172.7	281.0	61	51
Boston, Mass	T.	.....	.....	32	31	35	47	47	48	48	43	41	34	25	.....	.....	.....	118.6	294.9	40	32
Buffalo, N. Y	T.	.....	.....	12	8	19	30	34	33	34	30	23	8	7	.....	.....	.....	67.2	292.3	23	12
Charleston, S. C	T.	.....	.....	47	47	55	76	80	76	75	72	65	51	51	50	.....	.....	201.1	314.0	64	62
Chattanooga, Tenn	T.	.....	.....	51	45	45	54	61	65	61	66	59	55	51	50	.....	.....	173.9	310.1	56	52
Cheyenne, Wyo	P.	.....	.....	48	41	47	62	62	71	73	73	64	63	59	.....	.....	.....	182.0	297.3	61	52
Chicago, Ill	T.	.....	.....	15	10	20	35	39	42	48	43	36	23	21	.....	.....	.....	94.0	294.9	32	31
Cincinnati, Ohio	T.	.....	.....	32	39	49	48	48	46	53	46	42	37	38	.....	.....	.....	133.6	301.5	44	43
Cleveland, Ohio	T.	.....	.....	8	11	14	19	21	28	23	23	20	19	22	.....	.....	.....	58.1	294.9	20	16
Columbus, Ohio	T.	..	.....	17	17	20	28	31	31	33	31	29	19	18	.....	.....	.....	76.5	299.7	26	27
Denver, Colo	P.	.....	.....	65	50	63	62	69	71	66	73	65	70	68	.....	.....	.....	196.9	299.7	66	47
Des Moines, Iowa	T.	.....	.....	43	53	54	57	56	57	58	59	52	56	51	.....	.....	.....	162.5	294.9	55	55
Detroit, Mich	T.	.....	.....	15	12	23	34	37	36	35	27	22	29	15	.....	.....	.....	79.8	294.9	27	23
Dodge City, Kans	P.	.....	.....	54	64	82	81	79	73	73	76	73	72	68	100	.....	.....	223.9	304.0	74	66
Dubuque, Iowa	T.	.....	.....	36	27	34	39	49	49	55	50	48	38	34	.....	.....	.....	125.3	294.9	42	45
Eastport, Me	P.	.....	.....	34	30	37	46	44	39	34	39	39	29	21	.....	.....	.....	105.4	287.2	37	26
Erie, Pa	T.	.....	.....	8	6	13	20	26	29	25	16	11	10	7	.....	.....	.....	48.5	294.9	16	26
Eureka, Cal	P.	.....	.....	10	11	20	34	42	42	39	42	41	37	30	.....	.....	.....	99.4	297.3	33	33
Fresno, Cal	P.	.....	.....	61	55	72	82	84	84	84	89	90	80	63	100	.....	.....	238.4	305.7	78	63
Galveston, Tex	P.	.....	.....	42	56	67	72	73	69	68	70	73	70	53	50	.....	.....	210.9	321.7	66	61
Harrisburg, Pa	T.	.....	.....	46	30	31	43	55	68	73	62	46	28	25	.....	.....	.....	139.9	299.7	47	29
Helena, Mont	P.	.....	.....	29	24	34	35	39	34	34	37	39	32	21	.....	.....	.....	91.9	281.0	33	29
Huron, S. Dak	T.	.....	.....	6	14	21	47	59	68	75	67	56	28	33	.....	.....	.....	136.4	289.7	47	45
Idaho Falls, Idaho	T.	.....	.....	44	31	35	32	40	39	34	33	32	23	20	.....	.....	.....	95.5	292.3	33	30
Indianapolis, Ind	T.	.....	.....	42	44	45	45	46	43	49	44	36	32	30	.....	.....	.....	124.4	299.7	42	33
Jacksonville, Fla	T.	.....	.....	48	49	55	66	75	74	74	69	67	59	51	60	.....	.....	201.8	319.7	63	48
Kansas City, Mo	P.	.....	.....	48	47	50	57	63	63	62	57	50	39	44	.....	.....	.....	160.7	301.5	53	52
Key West, Fla	T.	.....	.....	56	53	60	77	84	86	85	85	76	76	63	62	.....	.....	239.2	328.2	73	61
Knoxville, Tenn	T.	.....	.....	24	26	47	63	74	74	76	71	71	67	55	50	.....	.....	187.7	308.3	61	58
Little Rock, Ark	T.	.....	.....	56	59	67	74	76	86	87	82	80	68	60	50	.....	.....	227.3	310.1	73	54
Los Angeles, Cal	P.	.....	.....	79	78	81	86	88	93	96	93	93	89	84	100	.....	.....	273.6	312.2	88	81
Louisville, Ky	T.	.....	.....	43	51	55	53	55	57	62	62	54	51	44	0	.....	.....	164.8	304.0	54	40
Minneapolis, Minn	T.	.....	.....	28	23	29	34	32	45	43	38	27	13	10	.....	.....	.....	87.1	287.2	30	.....
Nashville, Tenn	T.	.....	.....	51	49	55	54	59	59	59	57	54	52	49	20	.....	.....	168.2	308.3	55	52
New Orleans, La	T.	.....	.....	35	37	63	69	70	76	73	69	58	44	32	32	.....	.....	183.5	319.7	57	58
New York, N. Y	T.	.....	.....	13	27	50	53	56	63	61	63	58	40	35	.....	.....	.....	149.2	297.3	50	34
Northfield, Vt	P.	.....	.....	19	26	29	35	34	32	33	28	22	17	13	.....	.....	.....	79.3	289.7	27	20
Omaha, Nebr	P.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50
Parkersburg, W. Va	T.	..	.....	26	27	30	40	46	48	45	41	32	20	11	.....	.....	.....	103.2	301.5	31	31
Philadelphia, Pa	T.	.....	.....	31	30	43	53	57	55	55	57	52	35	36	.....	.....	.....	141.0	299.7	47	36
Phœnix, Ariz	P.	.....	.....	77	84	92	97	96	98	97	92	91	88	81	62	.....	.....	285.4	314.0	91	76
Pittsburg, Pa	T.	.....	.....	3	20	29	40	45	42	44	40	33	24	24	.....	.....	.....	100.0	297.3	34	29
Portland, Me	T.	.....	.....	3	22	42	48	52	52	54	52	42	29	24	.....	.....	.....	122.0	289.7	42	34
Portland, Oreg	T.	.....	.....	0	0	8	18	31	37	37	37	31	10	9	.....	.....	.....	63.9	284.1	23	15
Portland, Oreg	P.	.....	.....	0	0	4	9	18	10	21	22	14	8	9	.....	.....	.....	33.4	284.1	12	15
Raleigh, N. C	T.	.....	.....	46	43	58	70	80	81	85	81	71	63	42	50	.....	.....	206.2	308.3	67	56
Rochester, N. Y	T.	.....	.....	9	4	16	26	34	40	24	26	16	13	11	.....	.....	.....	62.4	292.3	21	20
St. Louis, Mo	T.	.....	.....	22	31	52	58	63	69	68	64	50	42	26	.....	.....	.....	157.0	301.5	52	46
St. Paul, Minn	P.	.....	.....	21	26	31	40	46	46	45	43	47	37	36	.....	.....	.....	113.9	287.2	40	37
Salt Lake City, Utah	P.	.....	.....	42	33	36	42	52	59	50	47	49	47	29	.....	.....	.....	133.1	297.3	45	40
San Diego, Cal	P.	.....	.....	68	68	78	90	91	93	92	89	90	86	78	62	.....	.....	266.3	314.0	85	83
San Francisco, Cal	T.	.....	.....	14	20	50	66	71	80	77	74	70	60	29	0	.....	.....	178.9	304.0	59	44
Santa Fe, N. Mex	P.	.....	.....	70	76	84	89	84	78	86	88	79	80	70	50	.....	.....	249.6	308.3	81	70
Savannah, Ga	P.	.....	.....	53	55	64	70	72	72	73	71	64	64	58	75	.....	.....	207.6	315.9	66	58
Seattle, Wash	T.	.....	.....	0	0	0	4	11	13	7	3	1	0	0	.....	.....	.....	11.7	278.0	4	12
Spokane, Wash	T.	.....	.....	0	2	6	14	21	24	23	17	16	7	9	.....	.....	.....	39.7	278.0	14	12
Tacoma, Wash	T.	.....	.....	12	6	6	15	24	22	21	20	11	14	18	.....	.....	.....	44.0	281.0	16	10
Tampa, Fla	T.	.....	.....	76	69	69	80	74	72	62	67	64	54	63	65	.....	.....	219.6	323.5	68	65
Vicksburg, Miss	T.	.....	.....	44	46	61	62	70	72	75	81	77	74	53	42	.....	.....	208.0	315.9	66	65
Washington, D. C	P.	.....	.....	49	47	55	60	58	61	54	57	54	52	48	.....	.....	.....	164.6	301.5	55	49
Wilmington, N. C	T.	.....	.....	46	54	66	73	79	86	85	81	77	72	54	50	.....	.....	223.5	312.2	72	65
Yankton, S. Dak	T.	.....	.....	49	41	49	61	69	71	70	63	60	54	41	.....	.....	.....	171.2	292.3	58	48

TABLE XI.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour during November, 1897, at all stations furnished with self-registering gauges.*

Station.	Date.	Total duration.		Total amt of precipitation.	Excessive rate.		Amount before excessive began.	Depths of precip tation (in inches) during periods of time as indicated.													
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Albany, N. Y.	1-2			1.90														0.18			
Atlanta, Ga.	26			0.96														0.37			
Atlantic City, N. J.	1-2			1.61														0.45			
Baltimore, Md.	1-2			1.67														0.17			
Binghamton, N. Y.	1-2			0.86														0.10			
Bismarck, N. Dak.*																					
Boston, Mass.	11-12			1.87														0.30			
Buffalo, N. Y.*																					
Cairo, Ill.	15-16	11.50 p. m.	5.30 a. m.	1.73	12.15 a. m.	1.45 a. m.	T.	0.08	0.11	0.16	0.20	0.30	0.41	0.47	0.55	0.58	0.67	0.80	0.94	1.16	1.25
Charleston, S. C.	1			0.14														0.10			
Chicago, Ill.	8-9			0.69														0.16			
Cincinnati, Ohio	26			0.84														0.62			
Cleveland, Ohio	14			0.53														0.09			
Columbia, Mo.	6-7			0.76													0.40				
Columbus, Ohio	7-8			1.06														0.27			
Denver, Colo.*																					
Des Moines, Iowa.	25-26			0.17														0.04			
Detroit, Mich.	8-9			1.38														0.38			
Dodge City, Kans.	4			0.03														0.02			
Duluth, Minn.*																					
Eastport, Me.	9			1.08														0.50			
Erie, Pa.	8-9			0.67														0.22			
Galveston, Tex.	10			0.56														0.34			
Harrisburg, Pa.	1-2			2.10														0.18			
Hatteras, N. C.	2			0.22														0.16			
Huron, S. Dak.*																					
Idaho Falls, Idaho*																					
Indianapolis, Ind.	16			1.29														0.64			
Jacksonville, Fla.	1			0.94														0.40			
Jupiter, Fla	27	4.00 a. m.	8.30 a. m.	1.43	6.45 a. m.	7.20 a. m.	0.10	0.25	0.45	0.58	0.76	0.92	1.09	1.20							
Do	30	12.50 p. m.	9.30 p. m.	3.06	4.50 p. m.	5.50 p. m.	0.74	0.06	0.12	0.16	0.23	0.36	0.64	0.85	1.01	1.18	1.32	1.66			
Kansas City, Mo	6-7			0.71														0.41			
Key West, Fla.	18-19	8.42 p. m.	D. N.	0.92	8.52 p. m.	9.17 p. m.	0.05	0.14	0.29	0.45	0.55	0.65									
Knoxville, Tenn.	8-9			0.65							0.29										
Lincoln, Nebr.	8			0.19														0.05			
Little Rock, Ark.	25			1.12														0.29			
Los Angeles, Cal.	24			0.01																	
Louisville, Ky.	8	12.02 p. m.	7.25 p. m.	0.86	5.39 p. m.	5.50 p. m.	0.33	0.30	0.45	0.47	0.48										
Memphis, Tenn.	16	1.35 a. m.	7.10 a. m.	1.17	1.35 a. m.	2.00 a. m.	0.00	0.15	0.29	0.40	0.51	0.55	0.58	0.61							
Milwaukee, Wis.	14			0.40														0.10			
Montgomery, Ala.	11			0.42														0.21			
Nantucket, Mass.	1-2			1.03														0.25			
Nashville, Tenn.	8			0.59														0.22			
New Orleans, La.	9	5.00 a. m.	5.55 a. m.	0.93	5.05 a. m.	5.30 a. m.	0.01	0.09	0.31	0.56	0.81	0.90									
New York, N. Y.	1-2			2.33														0.48			
Norfolk, Va.	29			0.85														0.47			
Northfield, Vt.	1-2			2.13														0.15			
Oklahoma, Okla.	14			0.58														0.30			
Omaha, Nebr.*																					
Parkersburg, W. Va.	26			0.68														0.30			
Philadelphia, Pa.	1-2			1.73														0.27			
Pittsburg, Pa	8			0.70														0.18			
Portland, Me.	27			0.64														0.49			
Portland, Oreg.	18-19			3.44														0.33			
Raleigh, N. C.	26-27			0.87														0.58			
Rochester, N. Y.	9			0.41														0.17			
St Louis, Mo.	15-16	6.03 p. m.	D. N.	1.39	7.11 p. m.	7.22 p. m.	0.05	0.20	0.32	0.37	0.39	0.44									
St. Paul, Minn.	25-26			0.27														0.04			
Salt Lake City, Utah.	23-24			0.38														0.14			
San Diego, Cal.	24			0.02																	
San Francisco, Cal.	22-23			0.42														0.17			
Savannah, Ga.	27			0.37														0.37			
Seattle, Wash.	16-18			3.49														0.24			
Spokane, Wash.*																					
Tampa, Fla.	1			0.58												0.50					
Vicksburg, Miss.	16			0.44														0.31			
Washington, D. C.	26-27			0.73														0.31			
Wilmington, N. C.	1-2			0.72														0.58			
Yankton, S. Dak.*																					

*Record incomplete.

TABLE XII.—*Excessive precipitation, by stations, for November, 1897.*

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
Alabama.	*Inches.*	*Inches.*		*Ins.*	*h.m.*	
Alco		3.90	1			
Scottsboro		3.75	18-19			
California.						
Crescent City	10.45					
Edmanton		2.81	23			
Grass Valley		2.78	23			
Greenville		2.50	19-20			
Do		3.49	22-23			
Laporte		3.91	20			
Do		3.28	23			
Malakoff Mine		2.92	22-23			
North San Juan		3.78	22			
Quincy		2.75	19-20			
Connecticut.						
Bridgeport		3.30	1-2			
Middletown		2.73	1-2			
New Haven		3.03	1-2			
Norwalk		2.80	1-2			
Voluntown		2.96	1-2			
Delaware.						
Newark		3.02	1-2			
Florida.						
Jupiter		4.00	*	1.30	1 00	27
Do				2.20	2 00	30
Merritts Island		5.08	25			
Milton		2.70	1			
New Smyrna		2.60	17			
Idaho.						
Lakeview		2.61	19			
Murray	10.98					
Illinois.						
Kankakee				1.20	1 00	14
Indiana.						
Franklin		2.50	7			
Jasper		2.80	1			
Shelbyville		2.73	7			
Kentucky.						
Blandville		2.77	1			
Louisiana.						
Baton Rouge		2.79	28			
Donaldsonville		4.40	28			
Emilie		2.98	28			
Grand Coteau		3.32	28			
Jeanerette		2.83	28			
Melville		2.50	28-29			
Opelousas		2.88	28			
Paincourtville		2.62	28			
Rayne		4.10	28			
Shelibeach		3.02	28-29			
Sugar Ex Station		2.75	28			
Wallace		2.82	28			
White Hall		4.60	28			
Maine.						
Cornish		2.88	1-2			
Maryland.						
Bachmans Valley		4.42	1-2			
Darlington		3.05	1			
Fallston		2.58	1-2			
Mt. St. Mary's College		2.59	1-2			
New Market		3.19	1-2			
Port Deposit		3.25	1-2			
Taneytown		3.47	1-2			
Westminster		4.36	1-2			
Woodstock		3.30	1-2			
Massachusetts.						
Fallriver		3.67	1-2			
Hyannis		4.72	1-2			
Middleboro		2.76	1-2			
New Bedford		5.80	1-2			
Woods Hole		4.19	1-2			
Worcester		2.73	1-2			
New Hampshire.						
Newton		3.04	1-2			
New Jersey.						
Charlotteburg		2.55	1-2			
Chester		3.30	1-2			
Sergeantsville		2.75	1-2			
New York.						
Middletown		2.92	1-2			
North Lake	10.24	3.85	26			
Palermo		2.75	30			
Setauket		3.08	1-2			
Wappingers Falls		2.84	1-2			
North Carolina.						
Flat Rock		3.15	1			
Greenville		2.50	29			
Lynn		2.50	1			

TABLE XII.—*Excessive precipitation*—Continued.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
North Carolina—Continued.	*Inches.*	*Inches.*		*Ins.*	*h.m.*	
Salem		2.52	26			
Saxon		2.60	25-26			
Ohio.						
Elyria		2.78	1-2			
Oberlin		3.34	1-2			
Portsmouth		3.18	7-8			
Rosewood		3.22	1-2			
Vermillion		3.31	1-2			
Waynesville		2.88	1-2			
Oregon.						
Albany	12.07	2.55	18			
Astoria	15.36	2.58	28-29			
Aurora (near)	11.14					
Bandon	15.98	4.10	19			
Bay City	28.00	2.86	9			
Do		3.05	18			
Do		2.52	21			
Do		3.52	29			
Cascade Locks	19.24					
Corvallis	11.66	3.08	18			
Falls City	20.54	8.23	19-20			
Fairview	15.21	2.82	19			
Forest Grove	13.74	5.20	17-18			
Gardiner	18.84	4.40	19			
Glenora	32.91	10.17	17-18			
Do		4.50	29			
Government Camp	18.76					
Hood River (near)	10.64					
Langlois	20.90	2.75	13			
Do		4.15	19			
McMinnville	15.38	4.31	19			
Monroe	16.61	3.95	19			
Mount Angel	12.88	3.36	18			
Nehalem	29.33	7.99	9-10			
Do		2.52	18			
Newberg	13.87	5.27	18-19			
Newport	17.76	2.50	10			
Do		3.00	19			
Portland	11.65	4.46	17-19			
Salem	11.67	3.11	19			
Stafford	14.62	3.45	19			
Toledo		3.15	17			
Vernonia	14.18	2.95	17			
Pennsylvania.						
Aqueduct		3.95	1-2			
Coatesville		2.50	1-2			
Coopersburg		3.50	1-2			
East Mauch Chunk		3.38	1-2			
Hamburg		3.76	1-2			
Pottstown		3.50	1-2			
Shawmont		3.46	1-2			
Swarthmore		3.30	1-2			
Swiftwater		3.00	1			
Rhode Island.						
Block Island		5.62	1-3			
Kingston	10.25	5.65	1-2			
Narragansett Pier		3.00	1-2			
Providence		2.91	1-2			
Tennessee.						
Hickory Withe		2.80	*			
Washington.						
Aberdeen	16.91					
Ashford	19.19	3.00	19			
Cascade Tunnel		6.74	17-18			
Chehalis	11.68					
Clearwater	23.85	4.60	9			
Do		6.32	17-18			
Ellensburg (near)		3.00	23			
Fort Canby	14.99					
Grandmound	13.18	3.77	17-18			
Lacenter	13.78					
Lapush	14.26					
Mayfield	14.37					
Northbend		6.14	18-19			
Olympia	13.01	2.82	18			
Pysht	14.37	6.27	17-18			
Seattle		2.66	17-18			
Southbend	18.68	2.90	9			
Stampede	13.15					
Tacoma	12.31					
Union City	19.41	8.45	17-18			
Vashon	12.35	3.00	17-18			
West Virginia.						
Point Pleasant		2.52	8-9			

*November 30-December 1.

ERRATUM.

On page 487, second column, 7th line, for Fig. 2, read Fig. 1.

Chart I. Tracks of Centers of High Areas. November, 1897.

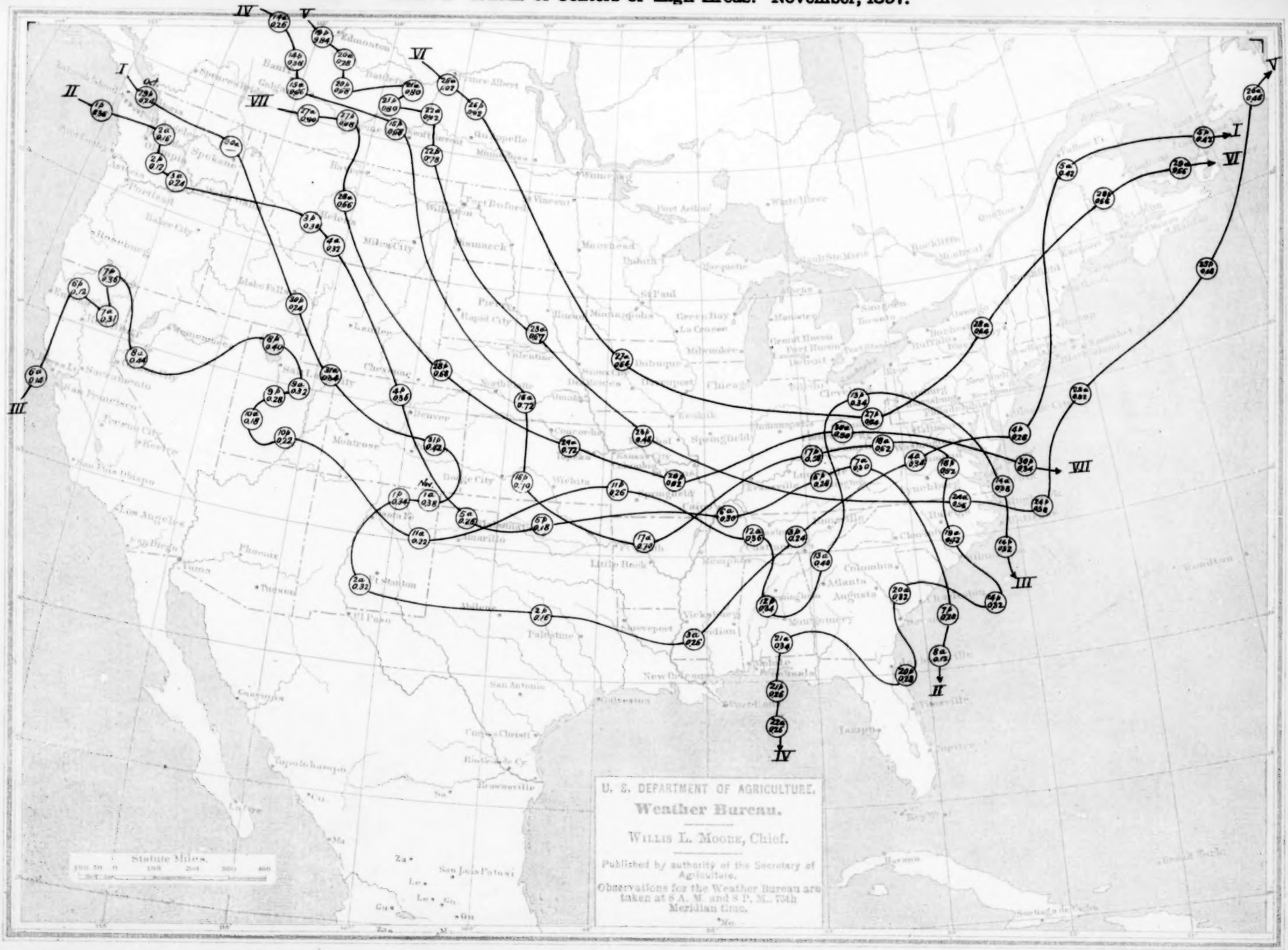


Chart II. Tracks of Centers of Low Areas. November, 1897.

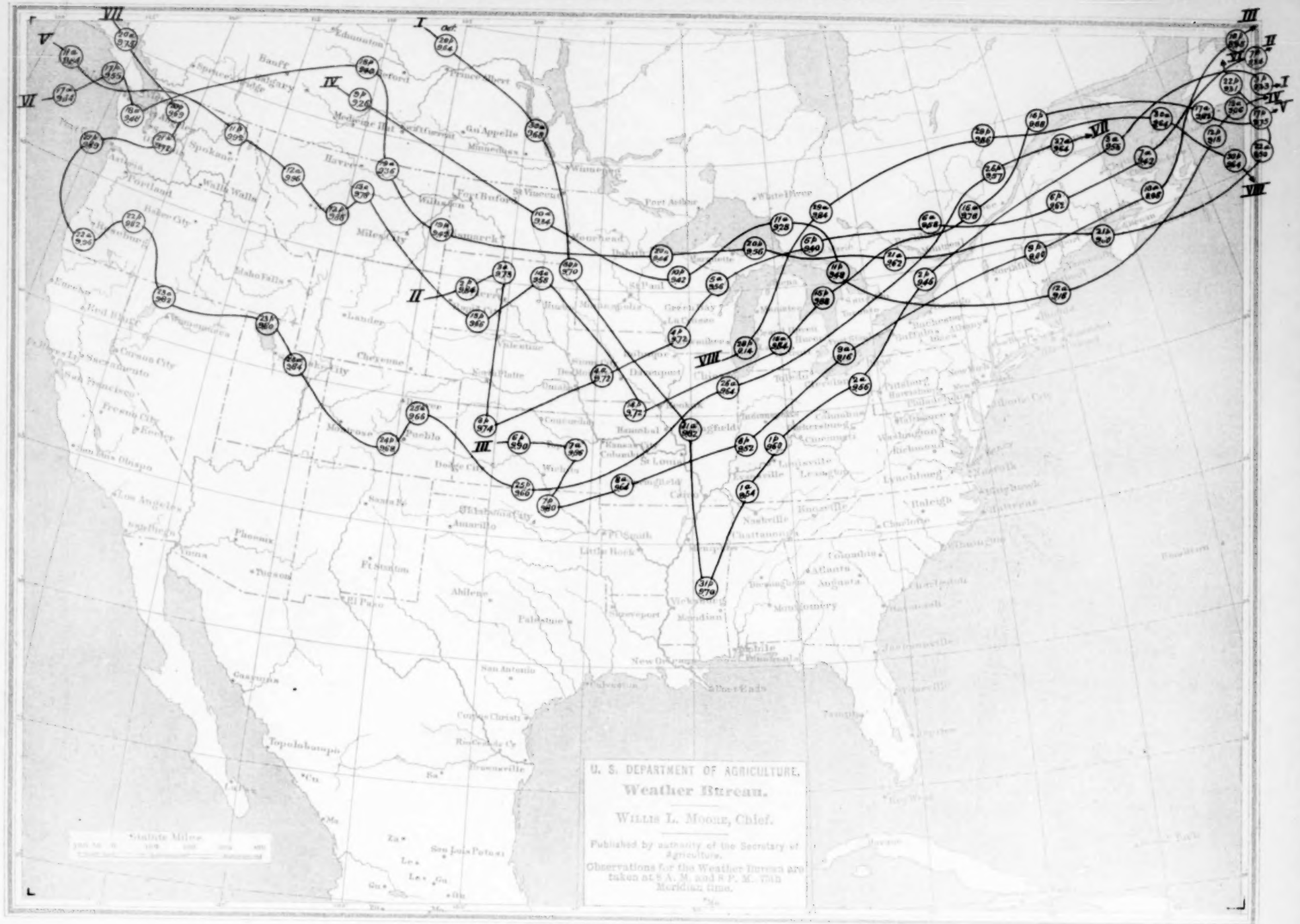

U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
WILLIS L. MOORE, Chief.
Published by authority of the Secretary of Agriculture.
Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M. 75th Meridian time.

Chart III. Total Precipitation. November, 1897.

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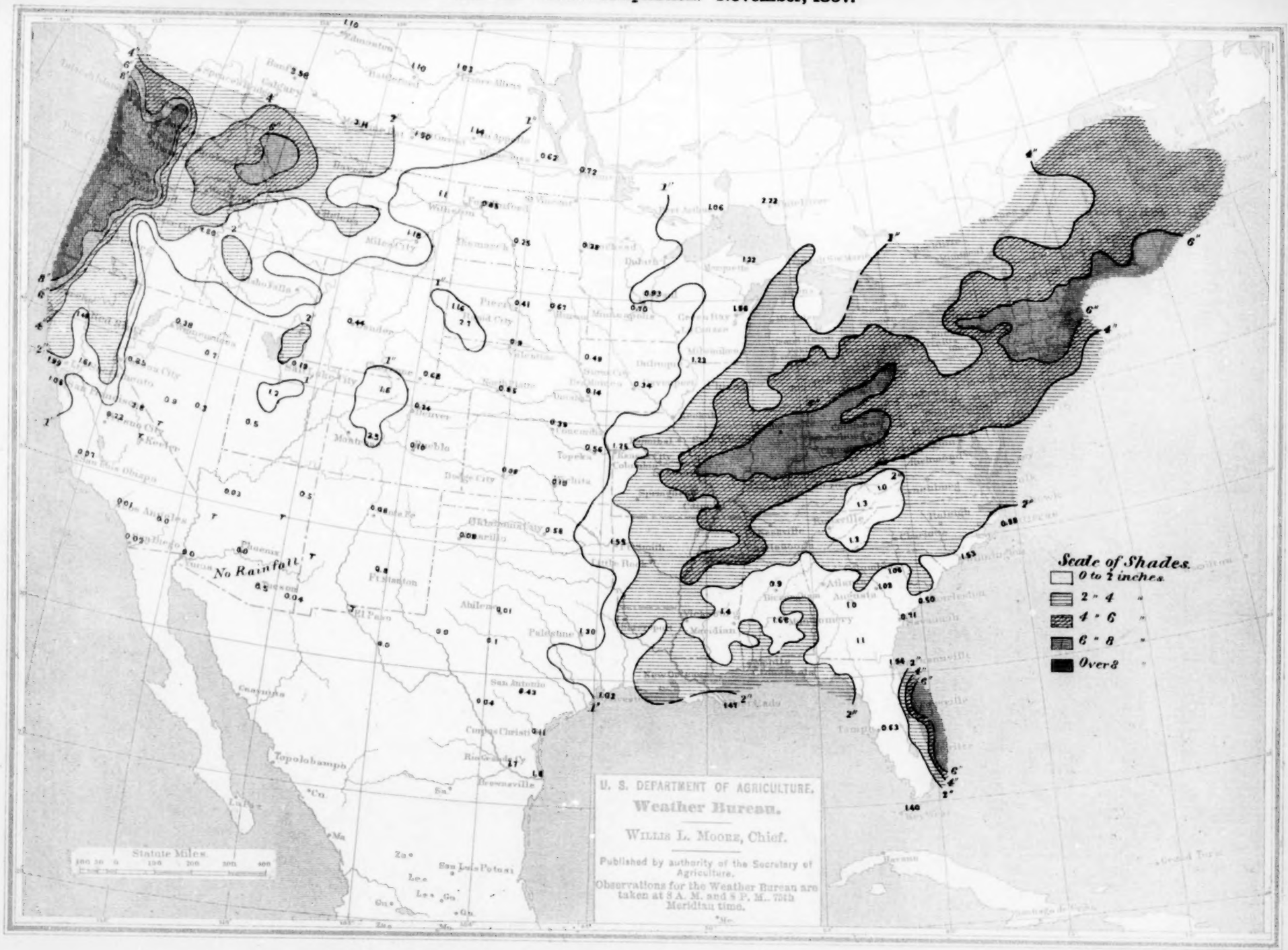
No Rainfall
Scale of Shades.
0 to 2 inches.
2 " 4 "
4 " 6 "
6 " 8 "
Over 8
Statute Miles
U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
WILLIS L. MOORE, Chief.
Published by authority of the Secretary of Agriculture.
Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M., 75th Meridian time.

Chart IV. Isobars, Isotherms, and Resultant Winds. November, 1897.

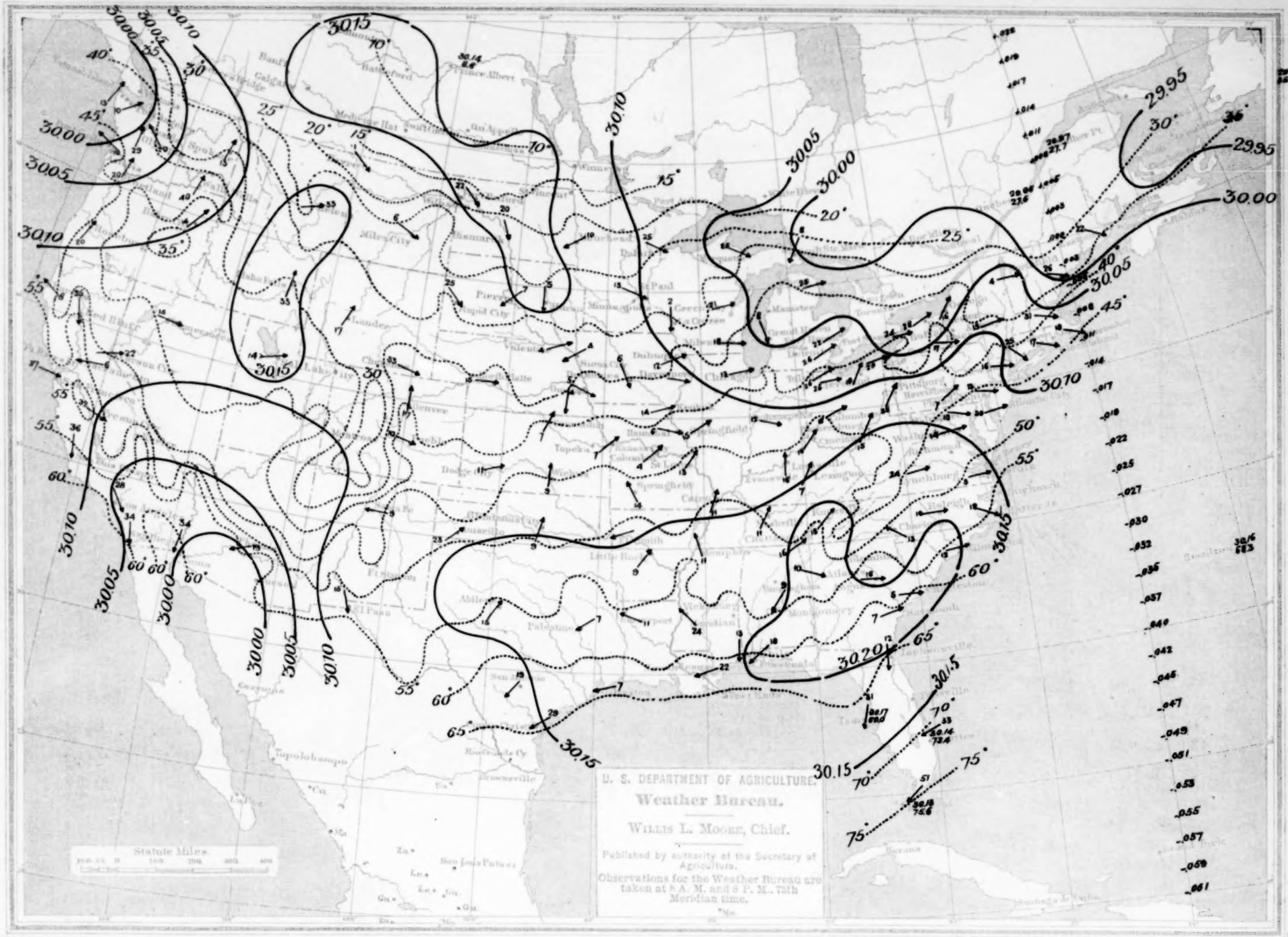
U. S. DEPARTMENT OF AGRICULTURE.
Weather Bureau.
WILLIS L. MOORE, Chief.
Published by authority of the Secretary of Agriculture.
Observations for the Weather Bureau are taken at 8 A. M. and 8 P. M., 75th Meridian time.
Statute Miles

Chart V. Hydrographs for Seven Principal Rivers of the United States. November, 1897.

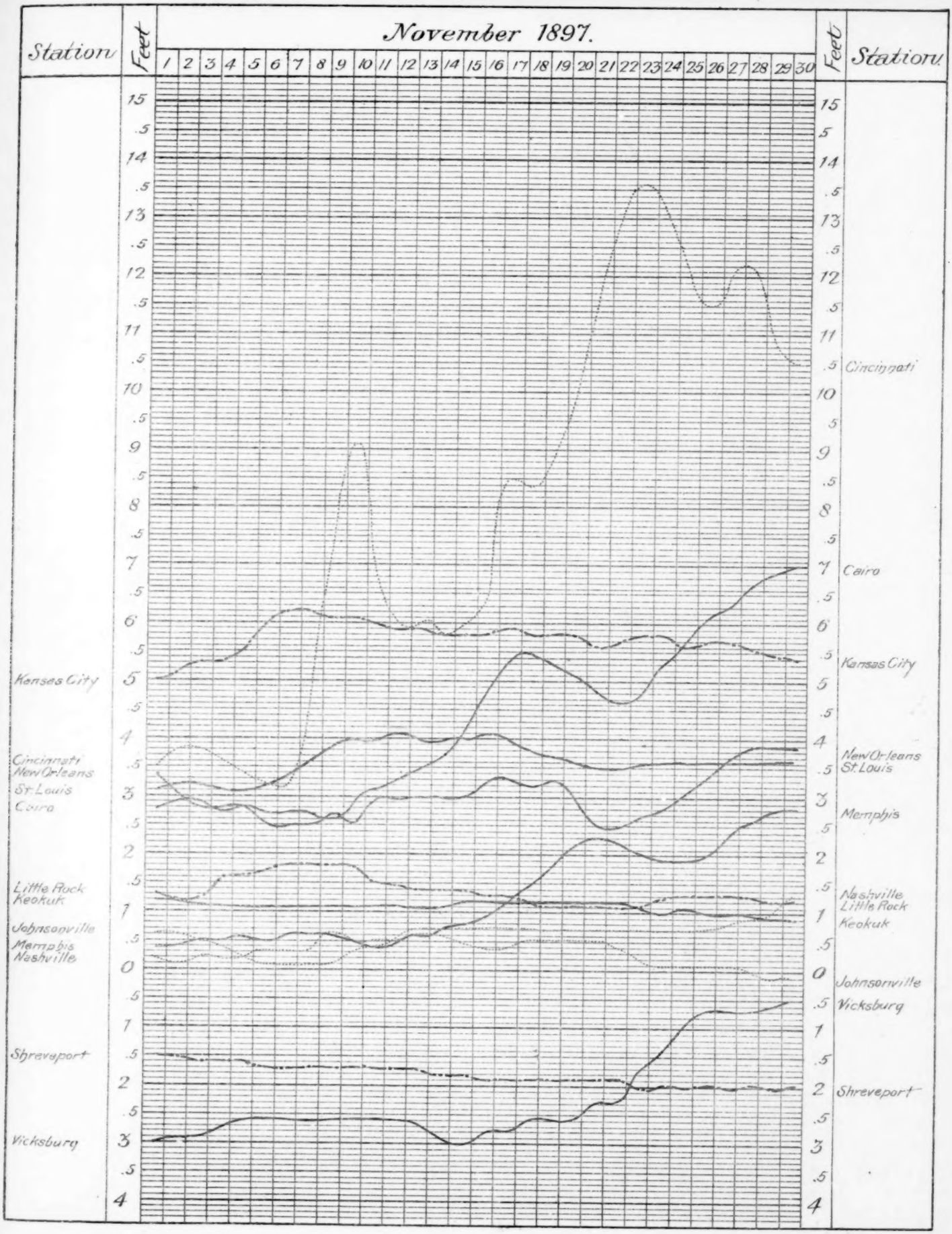

Chart VI. Total Snowfall (inches) and Limits of Freezing Weather. November, 1897.

Chart VI. Total Snowfall (inches) and Limits of Freezing Weather. November, 1897.

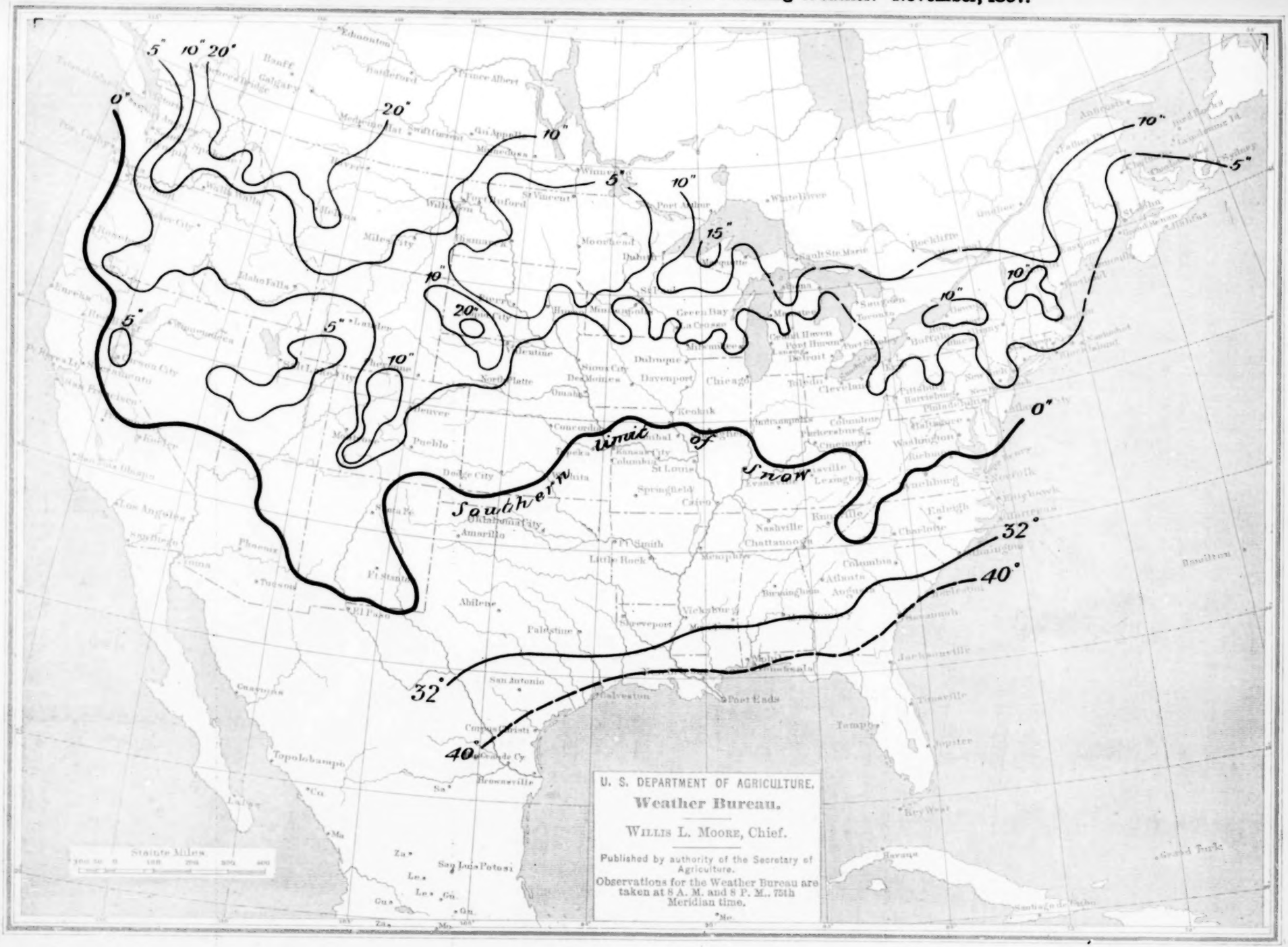

Chart VII. Depth of Snow on Ground at the Close of the Month. November, 1897.

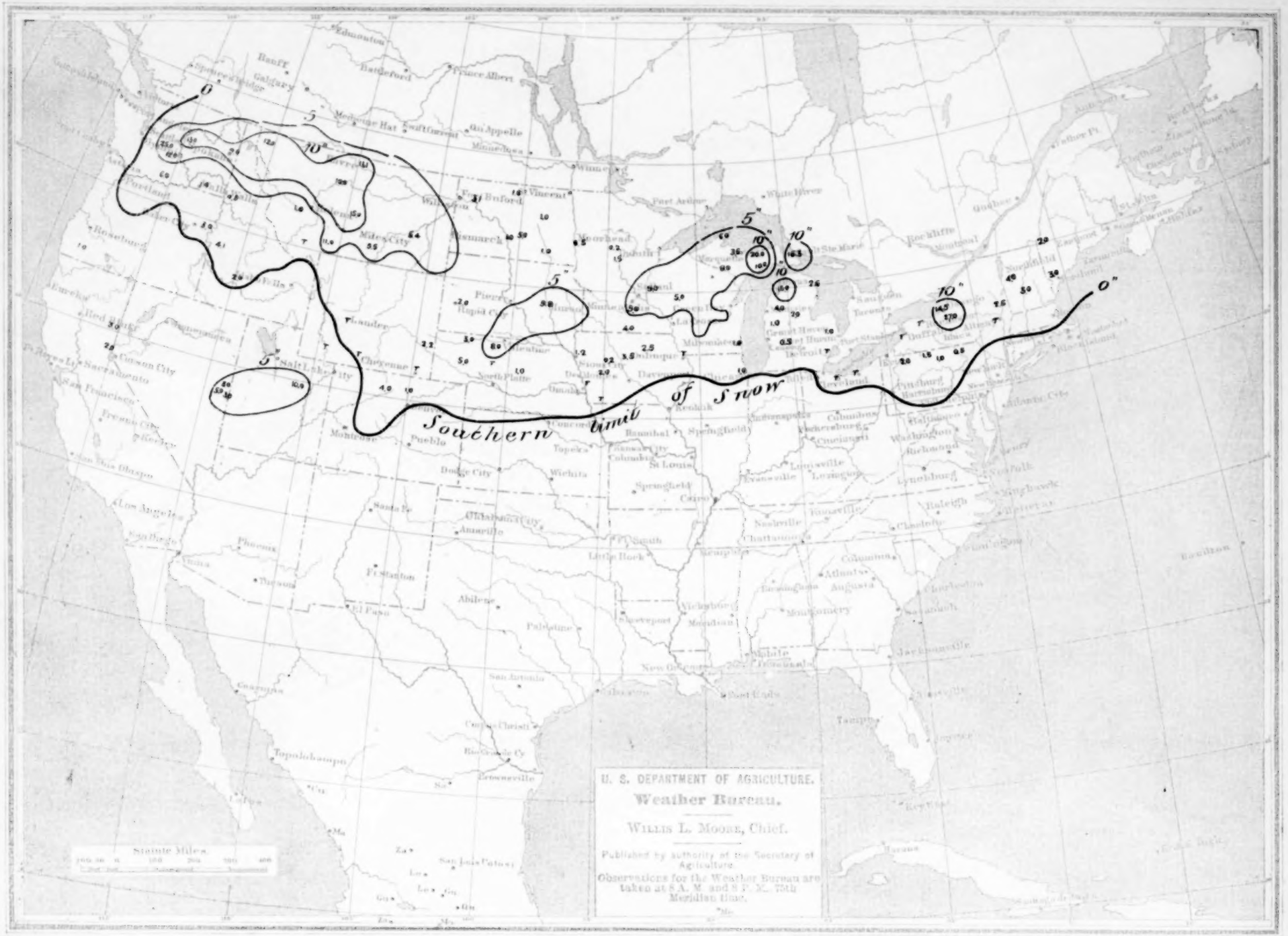

Chart VIII. Mount Tamalpais Station and Surroundings.

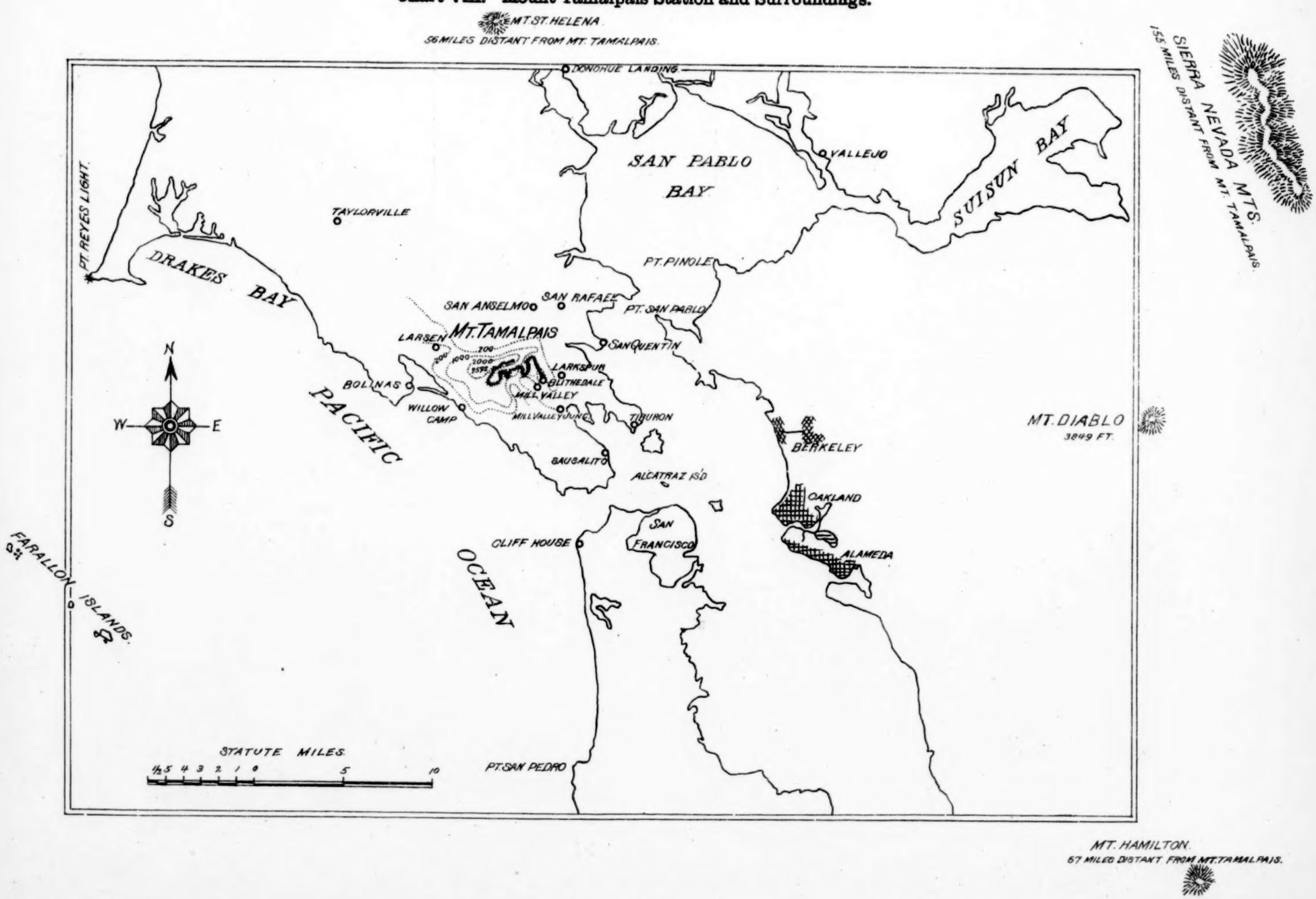

Chart IX. Photo-Thermo Sunshine Records.

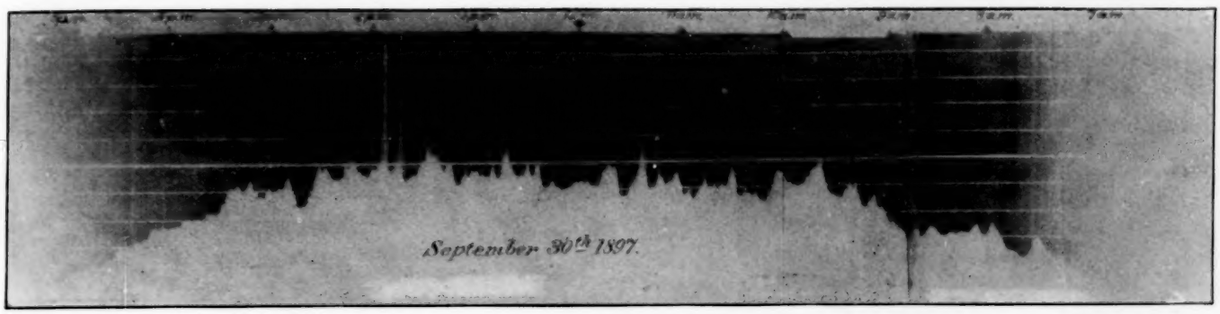

FIG. 4.—Photo-thermo sunshine record, September 30, 1897. Washington, D. C.

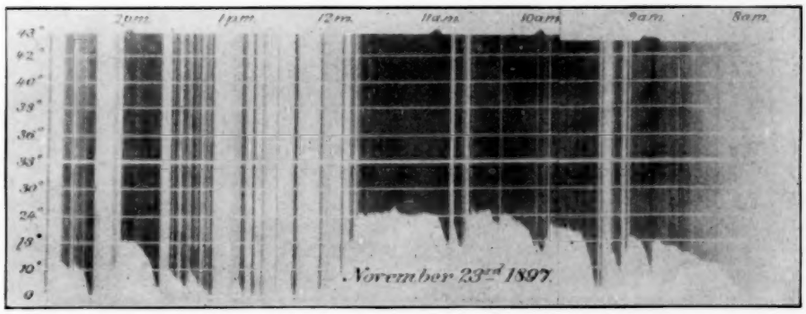

FIG. 5.—Photo-thermo sunshine record, November 23, 1897. Washington, D. C.
(Record for a part of the day, i. e., 7:50 a. m. to 2:40 p.m.)

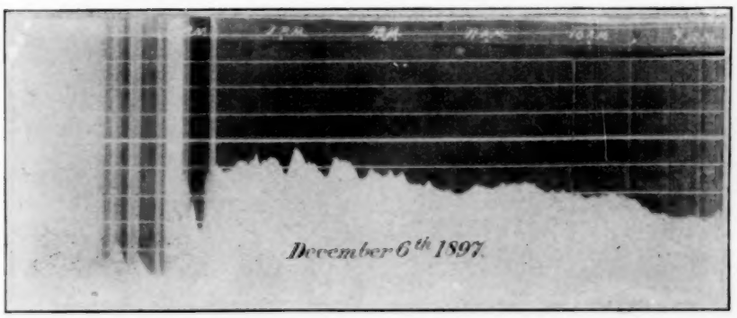

FIG. 6.—Photo-thermo sunshine record, December 6, 1897. Washington, D. C.
(Record for a part of the day, i. e., 8:40 a. m. to 3:20 p. m.)